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Personal Computing

SEPTEMBER 1978

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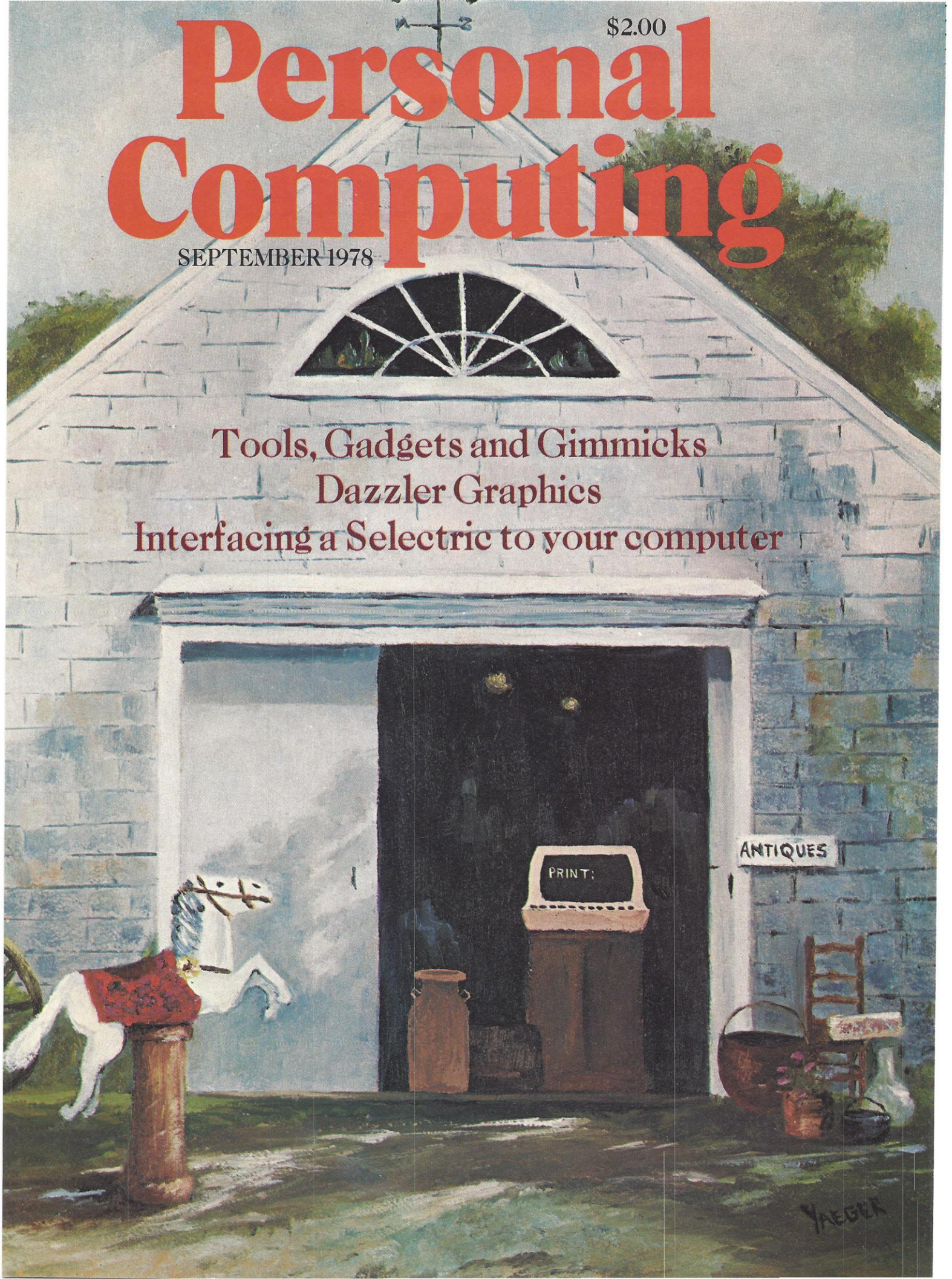

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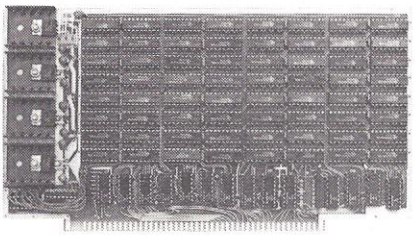

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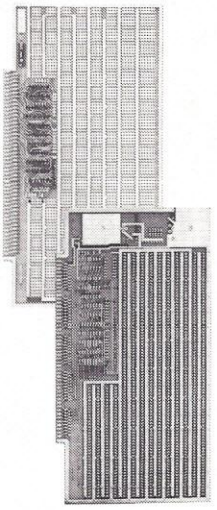

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IM Magazine, January 1978, writes, "THE PET comes of the box, plugs into the wall, and is ready to use." It is uipped with a CRT video display with reverse and blink atures, an alpha-numeric keyboard with complete graphics d a built-in standard cassette tape deck.

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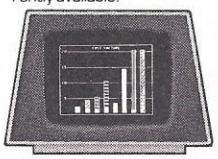
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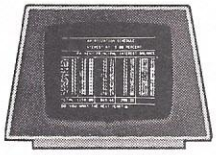
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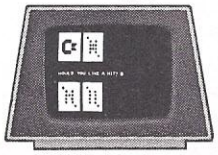
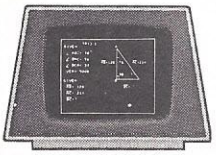

Black Jack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Read Only Memory (operating system resident in the computer); 14K bytes
8K-BASIC interpreter program, 4K-Operating system, 1K-Diagnostic routine

VIDEO DISPLAY UNIT
9" enclosed, black & white, high resolution CRT
1000 character display, arranged 40 columns by 25 lines
8 x 8 dot matrix for characters and continuous graphics
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CIRCLE 4

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CIRCLE 5

Personal Computing

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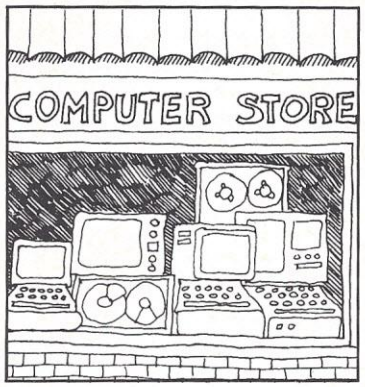

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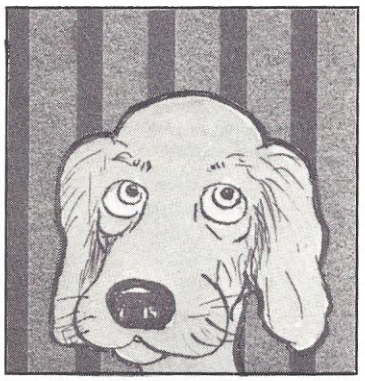

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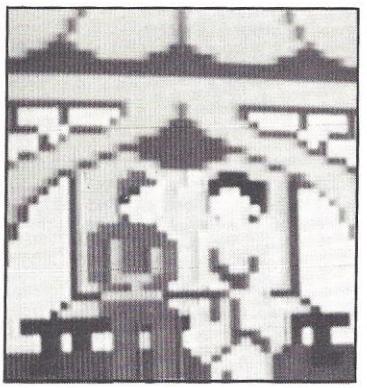

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Personal Computing

SEPTEMBER 1978 VOL. II, NO. 9

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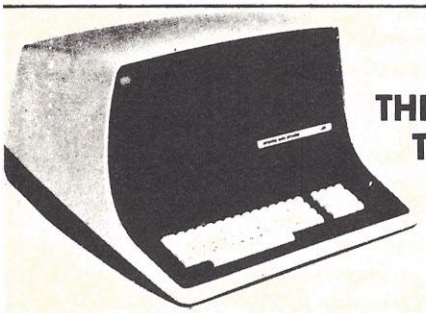

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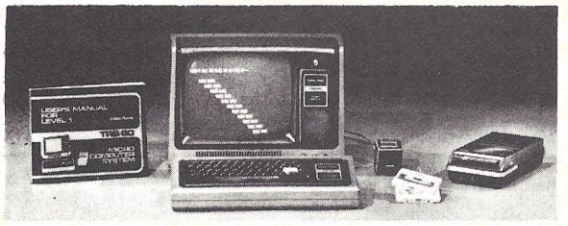

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CIRCLE 8

FEEDBACK

No-Sort Shell Sort?

Dear Editors:

One of my workmates, and fellow reader of my issues, noted a rather obvious bug in the Shell Sort on page 76 of the June 1978 issue. Line 1460, as coded, makes for a fast execution but does not sort any data. We suggest that you swap the N and the D.

I am not a BASIC expert by any means but I do modestly suggest that when a program is to be retyped for publication, as I assume this code was, that it be somewhat expanded to a more commonly known syntax. That is, it sure would have been nice if line 1460, above, was expanded to the common IF syntax.

John K. McCandliss
Florissant, MO

* * *

To the Editor:

I have found what appears to be a trivial error in the article "Relocatable Routines" by Robert Irving which appeared in the June issue.

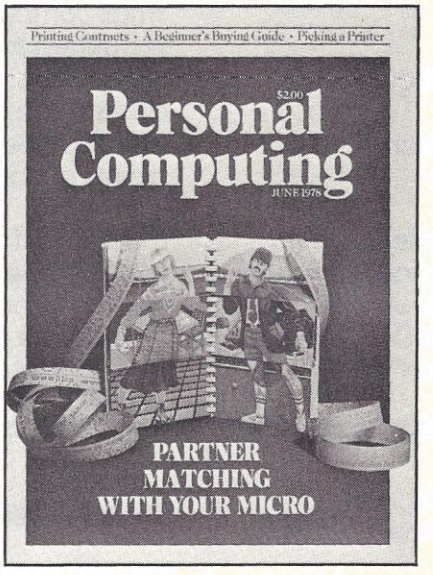
As the program is listed, "J" will always be equal to zero and the program will output whatever data are input without any changes in their order. In line 1440, "D" will be set to "I", which at this point is one more than "N". (The index of a loop terminates at one higher than its final value, this is where it "fails the test" and exits.) Therefore line 1450 makes D=twice (N+1) or D= 2N+2. Line 1460 then computes "J" as the integer of N/D, but since this is really N/(2N+1) the integer returned is always 0. When J=0 line 1470 sends the program to the exit, thus not altering the data.

Jerrold L. Patz
Wrentham, MA

Author's note: There are several typos in the program listing. (1) Line 1440 and unnumbered line to the left should read D=1. (2) Line 1470 should read IF J=0 THEN 1640. (3) Unnumbered line to left of line 1530 should read IF A(H) > = A(L) THEN (+80).

"N" is the number of items in the list to be sorted. "D" is a control variable which is initially equal to 2.0, and doubles following each pass through the list. "J" is the interval between any two items being compared during a pass, and must be an integer (INT function in BASIC), since there are no fractional or irrational positions in an ordinary list. If N is even, J is initially 1/2 the length of the list; if N is odd, J is (N-1)/2. The INT function (q.v.) performs this calculation by dividing N by D and truncating the result to an integer. INT cannot be expanded – it is the full function command. Most minimal BASICs include the INT function – perhaps you are familiar with a "Tiny BASIC" that does not include it. There is nothing "IFy" about the INT function – it produces an integer every time! And the Shell Sort most certainly sorts – using the program as written. Allowing for the odd/even list length mentioned above, the interval between items compared on successive passes is approximately N/2, N/4, N/8, N/16, N/32, N/64, N/128, etc. Once D becomes larger than N, INT(N/D) becomes zero, and line 1470 "IF J = 0 THEN 1640" terminates the sort. For more information, consult your library for a text such as "Sorting and Sort Systems" by Harold Lorin of IBM (pp. 37-43, Addison-Wesley, 1975).

–Robert Irving



Fair Game

Dear Sir:

I enjoyed the "No Strings Attached" article in your May 1978 issue, but was disappointed when it didn't run properly. While the program presented is very elegant in its efficiency, it has two logic errors: (1) When a digit value is repeated in the secret number and the guess it is possible to get a PPPV print out as the feedback hint. (Note: I have changed the X and I to P and V respectively for mnemonic benefit; P = position, V = value). (i.e., secret #1225, guess # = 1255, feedback hint = PPPV).
(2) Repeating digit values in the secret number and the guess caused extra V's to be printed out. (i.e. secret # = 2141, guess # = 4214, feedback hint = VVVV).

The following adjustments seem to correct both problems. I apologize for any lack of elegance or efficiency as I have only been programming for about a month.

- Line 200 – change X to P
- Add line 224 – FOR I = 5 to 8
- Add line 226 – B (I) = A (I): NEXT I
- Line 230 – replace J with K and A (J) with B (K)
- Line 240 and 260 – replace J with K
- Add line 242 – IF A (K-4) = 17 then 260
- Add line 244 – IF B (K) = 20 THEN 260.
- Line 250 – Change PRINT "I" to PRINT "V", insert B (K) = 20 after PRINT "V".

Ramon Yusi
Sherborn, MA

Author's Note: I thank Mr. Yusi for his letter and clever substitution of V and P for I and X. Take a moment and reread the article carefully. Notice the comment in the penultimate paragraph.

"Your guesses must be selected carefully and the hints interpreted correctly before you can hope to find the secret number in a minimum number of guesses."

Look at the two examples in Mr.

(Continued on next page)

September

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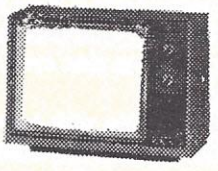

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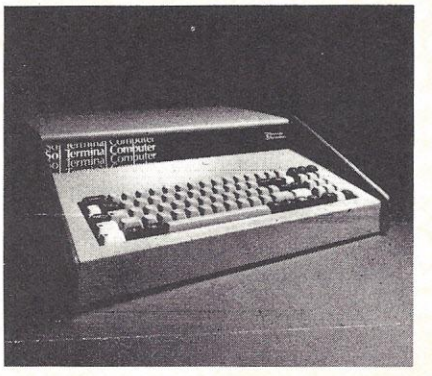
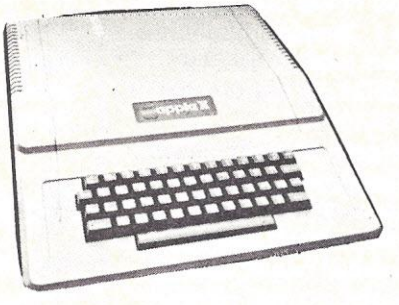
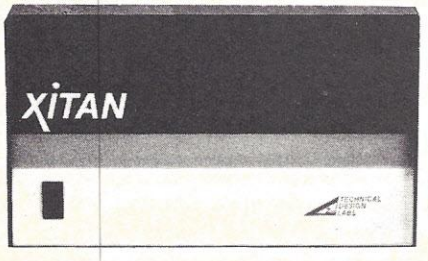


FREE RF Modulator and a $25 software package with every SOL computer in the store at our special low prices.





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CIRCLE 9

Yusi's letter. He may have misunderstood the computer's clues. In the first example, a secret number of 1225 and a guess of 1255 deserve a hint of PPPV. The first, second, and fourth digit in his guess have correct value and position. They earn the three Ps. The remaining digit, the third one, is correct in value, but not in position. It deserves a V.

In the second example Mr. Yusi used a secret number of 2141 and a guess of 4214. The clue is and should be VVVV. All four digits in his guess have the correct value but none of them are in the right position. They each deserve a V and they collectively deserve the four Vs.

In any event, readers should feel free to change the program any way that appeals to them. That is the beautiful thing about software games. If you don't like the way a game is played, you can change it to your specification.

–Bruce A. Scott

More Amortization

Dear Editor:

No doubt some of your readers have noticed that Charles DeLuca's Amortization Program (April 1978) occasionally has an error of one cent in the totals. In Figure 1, Sample Printout, the year end interest total for 1979 is $624.31, not $624.30; and for 1980 is $410.42, not $410.43.

The difference is probably caused by interest calculation being performed in floating point arithmetic. At lines 550 and 560 the monthly payment needs to be rounded to two decimal places, as the total monthly payment is at line 290.

To avoid this infuriating type of error – by Murphy's Law it occurs only on the customer's copy – use integer arithmetic to the nearest cent. This is an excellent rule for money calculations. Readers with FORTRAN, COBOL or ALGOL can specify this – BASIC and PL/1 may need assembly-language subroutines.

As the average price of a house increases, integer arithmetic has another advantage – accuracy. Typically a 32-bit machine has 23 bits of floating point accuracy: the exponent uses 8 bits and the sign, 1 bit. This handles about $80,000.00 maximum without allowing for roundoff. Integer arithmetic has 31-bit accuracy which will handle $20,000,000.00 to the nearest cent.

David M. Collison
Anaheim, CA

Author's Note: The letter from David Collison is very constructive and contains a fix to correct for errors in rounding of one penny. Thanks David!

–Charles Lawrence DeLuca

Crooked Shuffle

Dear Sir:

As it stands, Andrew Russakoff's card-shuffling program in the May issue is a crooked shuffle since it produces certain arrangements of numbers (cards) with greater frequency than others. This can be seen by working small examples. With a three-card deck for example, with original arrangement 123, the program produces the arrangement 132 6/27 of the time while it produces 321 only 5/27 of the time. The difference becomes more pronounced as the decks get larger. The program may be patched as follows:

```
50 FOR K=1 TO 51
60 LET R=INT (K+1+(N-K)* RND (5))
```

Essentially, this modification lets a card interchange only with cards below it in the deck. Now all arrangements are equally likely.

Professor Alan Filipski
Arizona State University
Tempe, AZ

Singapore Club

Dear Editor:

Though my friends and I are very anxious to form a computer hobbyist/users' club, due to the severe limitation to the amount of help which can be obtained locally, we are presently at a "snail's" pace. Being the first of its' kind – if it ever gets started – it is relatively hard to get qualified personnel who are free enough to help.

Hence as an alternative, I am seeking the help of any of your readers. For those who are already running a club/society, I would be most obliged if they could provide us with information on how your club/society was started; what you do during your meetings/gatherings; or any other information that may be of some help such as problems faced by the club/society.

Furthermore we hope that advertisers would be able to send us information, in the form of brochures, manuals or catalogs.

Hence in anticipation of any help which might be provided I would like to thank the person involved in advance for his/her effort and concern.

Steven Goh
3 Bristol Road
Singapore 8
Singapore

Editor's Note: One of the first things you should do is develop a roster of members, including their present and expected equipment. You'll want to duplicate the list and send it to each member (particularly if they are few and far between – and meetings are at best bi-monthly) so that everyone can keep in touch.

Second, you may wish to survey your members on buying habits, equipment usage and general demographic information. Keep the results on file. Such data will assist you in scheduling speakers, field trips, demonstrations and multi-media presentations.

Based on the results of this survey you can contact manufacturers for names and addresses of other customers of theirs in the area. Members will find sharing common interests a strong adhesive force in all club activities.

Also, members of other computer clubs reading this might drop you a note, suggesting additional ideas and opening a potentially valuable door to other multi-club activities.

Clubs often bring in someone from a local computer industry or offer the podium to a club member to discuss his system and/or software. "Flea markets" (selling and exchanging parts, magazines, systems, etc.) seem to be a big part of several club activities, but idle chit-chat and serious (panel) discussions keep meetings running at a good pace.

You may wish to start a small monthly newsletter. Exchange copies with other clubs; send copies to the media (e.g., *Personal Computing* magazine, local newspapers).

Plan some "fun" activities such as picnics, car washes, computer marathons and even bake sales.

No matter how small your club is at the start, you might find it bursting at the seams within a few months (especially if the industry and market continue to mushroom). Good luck – *G.D.*

Unquality Control?

Dear Editors:

On March 6, 1978 I ordered a 16K Level II TRS-80. On May 19th I picked up a 16K TRS-80. (No Level II to date but I was told at the TRS Show in New York that the Level II would be coming through in June.) No complaint about that. I know that TRS is swamped and priority will be given to early orders. But, on May 31st the CPU went back to the shop. Couldn't get a READY command on the CRT. It was a little slow the first day I plugged it in but it took longer and longer each time I turned the set on. Loading showed up as an unintelligible mishmash on the CRT. The TRS-80 had some sick chips in its guts.

Is there such a thing as quality control in the manufacture of microcomputers or are they just throwing the things together as fast as the little elves can work in the plant?

Alright. Even a $23,000 Rolls Royce can come with bugs as standard equipment but the TRS-80 only has a 90-day warranty. Suggestion: Owners should use a new microcomputer as much as possible the first few weeks to uncover unquality control.

Milton R. Roth
Danbury, CT

Editor's Note: Quality control is, of course, a vital concern in every manufacturing business. You could say that it is a self-destructive component, because any manufacturer who produces shoddy material will shortly find himself out of business. Drug manufacturers are particularly conscious of this because a bad product coming out of their labs can result in death, injury or enough liability claims to put them out of business. It is safe to say, then, that manufacturers, including computer manufacturers, large or small, are deeply concerned about quality control. If the product involves your safety or health then the government steps in to make sure that strict quality control is part of the manufacturing process. Even Santa Claus must have a quality control engineer in his North Pole factory because we haven't heard any complaints yet from kids when they unwrap their Christmas toys. – *H.S.*

Minicomputer vs. Microcomputer

Dear Editors:

When does a "micro" become a "mini", and vice-versa? When does a computer become a system? What is "word-processing" (example)? Thanks for a terrific magazine!

Bruce Showalter
Abilene, TX

Editor's Note: You can get into all sorts of heated hassles trying to determine the difference between a microcomputer and a minicomputer. Here are two definitions taken from the "Dictionary of Microcomputing" by Philip E. Burton, copyright 1976 by Garland Publishing Co., New York.

"*Microcomputer:* A small computer built around an LSI micrcoprocessor chip as it's CPU. Most microprocessors

need 4 to 12 additional semiconductor memory and I/O LSI packages to become microcomputers. There is nothing small about microcomputer capability—only its size and price tag. The minimum microcomputer is a microprocessor CPU plus an operating program in a ROM, a clock oscillator for timing and a DC power supply.

"*Minicomputer:* A small digital computer, somewhat larger, usually faster and more expensive than a microcomputer, but the cost of either is largely a function of its memory size. There is considerable overlap. Wordwise, 16 data bits seems to be the dividing line but categories of both have machines that size. Under 16 is definitely micro, but over 16 doesn't make it automatically a mini. With the bit/slice approach, which is definitely microcomputer oriented, you can put together, building block fashion, a computer with any word size, and write your own instruction set."

A computer becomes a system when you've set it up and it is running. It's the classic example of a pie. Take all the slices (peripherals, CPU, etc.), put them together, and you have a system. The number of slices is not important to the definition. Systems can occupy whole buildings or you can simply carry them around in your briefcase. If you have any kind of a computer on your desk and it does the job you want it to do, then you have a system.

Datapro Research Corporation of 1805 Underwood Blvd., Delran, NJ 08075, explains word processing in the introduction to its excellent book on word processing: "Word processing and processors have come a long way since the first rudimentary automatic typewriters made their debut back in the 1930's. Fostered by the demand to automate office typing and document preparation, this stepchild of the typewriter and the computer is now a full-fledged industry in its own right. Besides streamlining letter and report

Got a gripe? Found a bug? Want to comment or just sound off? Send your letters to Feedback, Personal Computing Magazine, 1050 Commonwealth Avenue, Boston, MA 02215. We'll consider each letter submitted and print the best and most interesting.

preparation, word processors are also opening up new vistas in message handling and communications, and in document storage and retrieval." For a more detailed explanation of the world of word processing, we suggest you write to Datapro at the above address.
H.S.

Straightening the Record

Editor's note: In our July cover story ("Music in Your Memory", by Rodger Pogue), we omitted a table of classification numbers used by the program. The numbers are:

0 Blues
1 Cast
2 Classical
3 Folk
4 Jazz
5 Oldies
6 Popular
7 Rock
8 Soundtrack
9 Cast

CATV No Big Brother Threat?

Gentlemen:

I have just completed the article by H. Paris Burstyn (May 1978) entitled "Big Brother . . . Sooner Than You Think?"

I am currently general manager of an operating two-way cable system in The Woodlands, Texas, where homes are equipped with computer communications terminals in constant (every 6-10 seconds) contact with a central computer, 24 hours a day. This system was installed with the principal initial objective of monitoring fire, police and medical alarm systems in each subscriber's home.

The effectiveness of the system speaks for itself. In nearly four years of operations, there has not been a single burglary loss and only one minor fire-related loss in a protected home. This system is used by 65% of all residents in The Woodlands.

Yes, we have the capability of turning a subscriber's set on and even of tuning it to a selected channel, under control of the central computer. We can also remotely control an alarm annunciator in the terminal and monitor responses to opinion polls, voting, etc., on a home-by-home basis, or by channel, or by type of response. The system has been used to enable residents to actively participate in local council meetings. We are currently developing a new generation of equipment that will permit home shopping, banking, information retrieval (library access) and other "esoteric" services to be delivered to each home.

Far from being a "1984"-type nightmare, this system and others are providing at least a partial answer to the nation's energy crisis by the substitution of electronic communications for "transportation" of information.

Donald T. Rozak
The Woodlands, TX

LOOKING FOR THE NEW KENTUCKY FRIED CHICKEN OR McDONALD'S? JUST OPEN YOUR EYES!

Back in the fifties, if someone had suggested you invest in a hamburger stand called McDonald's or a chicken store run by Colonel Sanders, you probably would have laughed. Most of us did. The few who didn't, and invested in KFC or Big Mac are millionaires today. They enjoy "finger lickin' good" profits and "have it all done" for them.

The whole trick to investing in your own business is to **keep your eyes open for something like a KFC or McDonald's**. A business that (1) requires a **small investment** that can be recouped quickly, (2) has an **enormous profit margin**, and (3) has great growing **consumer acceptance.**

There is such a business.

The business is computer portaits, and it's one of the hottest, most profitable new ideas around. International Entrepeneur's Magazine stated that there are locations that are currently grossing **from $2,000 to $4,000 a week**. Imagine, grossing up to $4,000 a week from a small investment that gives you **your own high volume, all cash business.** No franchise fees or royalty payments, **all the money is yours**.

Computer Amusement Systems, Inc., (CASI) of 11 West 20th Street in New York City, has taken today's hot trends—T.V., computers, and instant pictures and combined them to produce a computer portrait system that is high in quality, low in price, portable and **requires absolutely no photo or technical experience.**

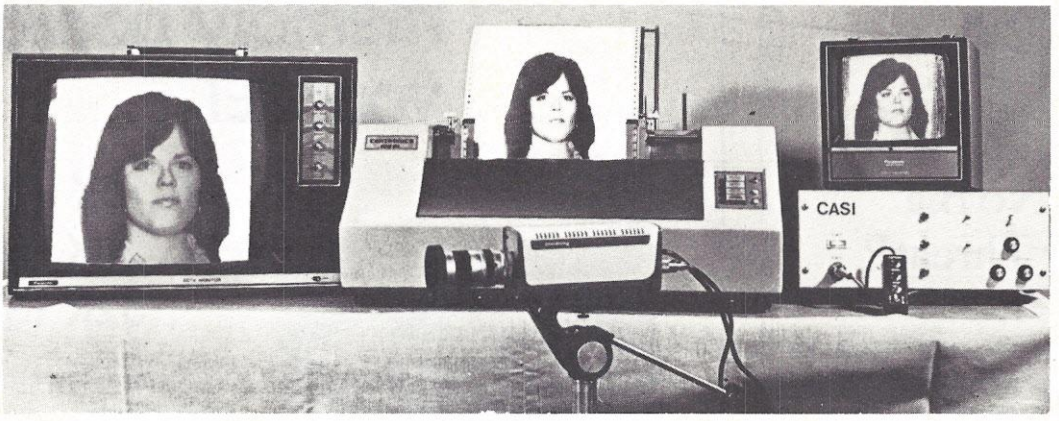
Easy to operate and easy to move, **the portable CASI system can be set up anywhere:** malls; flea markets; shopping centers; conventions; rock concerts, anywhere with high pedestrian traffic and just a little floor space. This **instant traffic stopper** will make a computer portrait in just fifty-five seconds! The picture is first seen on a T.V. screen, then dramatically printed before your eyes.

And there's more. You can transfer the portraits instantly to **many high mark-up, big profit items**—tote bags, T-shirts, calendars, puzzles, dart games—whatever the latest trend might be. CASI supplies the wholesale sources for everything you need to be in on the profits.

And there's more. Like special options that allow personalized messages to be printed right on the computer portrait. Or programs that will print out personal bio-rhythm charts in seconds. **All big moneymakers**.

So open your eyes to the most dynamic, profit making opportunity of the year. **Perfect for part time, full time, family operation or absentee management**, CASI is your ticket to success. Start putting money in your pocket today with CASI computer portrait systems. Don't send money just write for details. We'll send them right away.

Before you make an important decision in this exciting new business, know who you're buying from. We suggest you ask your banker about us.



YES! I WANT TO BE THE FIRST IN TOWN TO CASH IN ON COMPUTER PORTRAITS. PLEASE RUSH DETAILS

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City _____ **State** _____ **Zip** _____
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P

CIRCLE 13

RANDOM ACCESS

Computer rekindles romances

"Hello, 'If Ever I See You Again' and Pertec Computer Corp. would like to help you find your lost love. May I help you?"

Could this operator with the help of her XL40 Distributed Processing System and the Columbia Pictures publicity department really help me find my "lost love"?

"Yes, please," I said and then gave the information she wanted. My name (last name first) and phone number, my long lost love's name and the state we were last together in.

At this point I lied through my teeth. I gave her my secretary's name (someone I'd seen not five minutes before) and told the operator I'd last seen her in Colorado.

I'd already primed my secretary — she'd called in looking for me the day before; we were bound to find each other.

And so, hoped promoters for Columbia Picture's "If Ever I See You Again", would other long lost lovers.

Columbia and PCC's CMC Div. teamed up to help movie goers identify more closely with the characters in this film. "We did this promotion to give the public a chance to experience the same kind of feelings that the character in the film does," said Columbia Pictures project manager Elizabeth Cox.

In the movie, character Bob Morrison (played by Joe Brooks, the man who brought us "You Light Up My Life") experiences the hearbreak, trauma and final exhilaration of losing, living without and then regaining his own true love.

According to Columbia, the movie "is a contemporary love story with an intriguing premise: the poignancy of a person finding someone he loved and lost in the past only to discover that it is not too late to renew the relationship."

Brooks portrays a commercial songwriter who leaves New York to write film scores in California. "When we first started shooting the film, I considered numerous actors," said Brooks. "Many of them could have played the leading role. But the reason I finally decided to play the role myself was that it was imperative for the character to seem absolutely real. Since I'm a composer and a conductor I felt that I could convey that reality better than most actors."

In California, Brooks/Morrison becomes romantically involved with his former college sweetheart (Revlon's "Charlie Girl", Shelley Hack, in her screen debut) and realizes "the love he had been searching for was the love he had left behind," Columbia said.

Cox and Columbia advertising man Robert Cort thought up the unusual computerized publicity.

Since almost everybody shares an experience similar to the movie's (at least to the extent of losing a "childhood" lover), Cox said Columbia tried to make available a way for everybody to recapture that love.

"Obviously that has to be done by a computer," Cox said in a telephone interview. "I mean, if you've got calls in from all over the place we knew that we would need a computer to make any kind of match 'cause we wanted to make an immediate match. It couldn't be done any other way.

"We originally hoped the

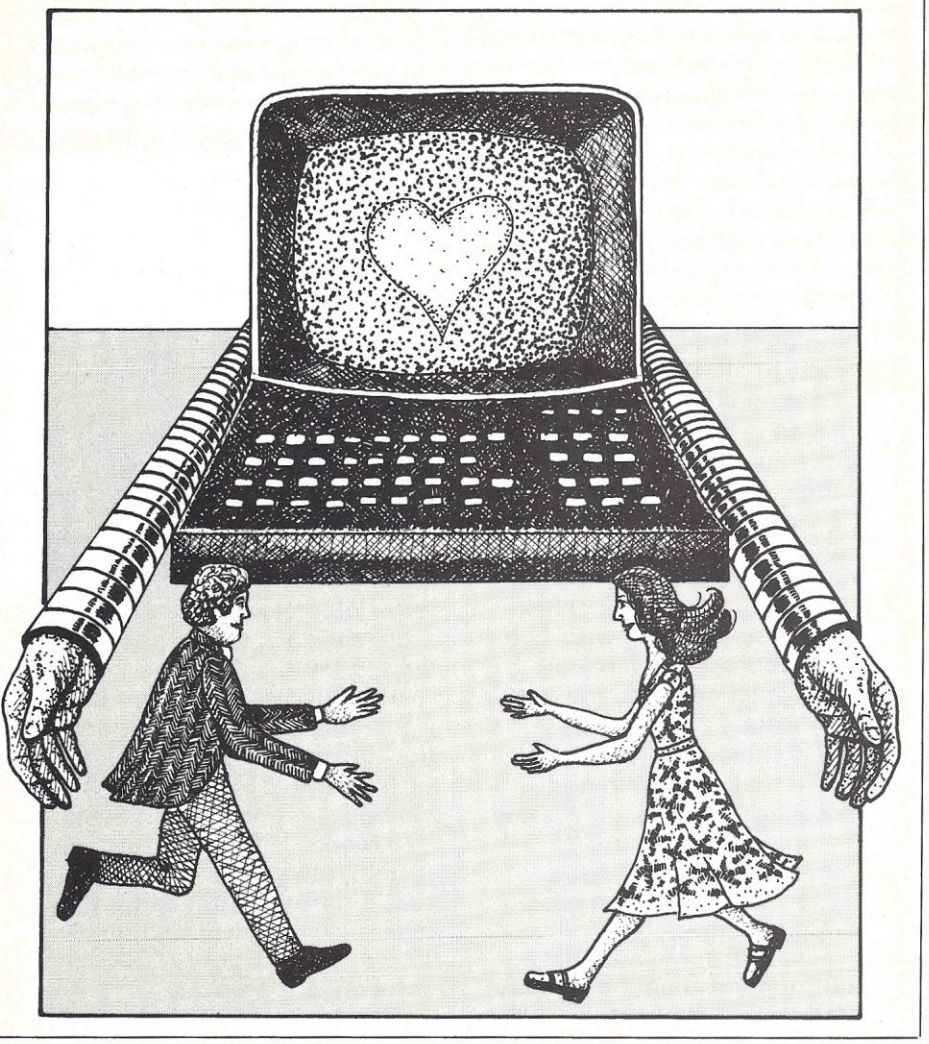


Illustration by Susan Howard

phone company might donate the lines," Cox said. But they didn't.

PCC donated the computer time and the operators, Cox said. "And they have just been fabulous. They even went so far as to program the computer to mark matches with a heart on the screen, which is just delightful."

According to Cox, PCC will also provide printouts by state so Columbia can see exactly where their publicity has the greatest impact.

"I think people think of computers as things that give you double bills (not the movie kind) and this is a nice way to say that computers can do something good for you."

Getting a computer company to cooperate on this venture was not easy for Columbia. "We talked to various computer companies, including all of the big ones," Cox said. "We got responses that varied from 'let me tell you up front that we never do this kind of thing' and that was the end of the conversation, to other people saying they didn't think they could do the programming in time or 'we wished you called earlier.' One said they would worry about if if they connected the wrong people. Although we feel we've built a completely safe system.

"First of all, if both people don't call looking for each other there's no match made. It doesn't count if you call looking for someone if they don't call looking for you. They might call looking for someone else, but it won't match with you.

"Secondly, to double check that we're not dealing with two sets of people with identical names, which could be the only way a mistake could be made, we are making a call back just to verify that they went to the same college or same job — same city — that kind of thing.

"So, there's no way we're going to match the wrong people," Cox claimed.

"We've had some matches so far but none of them have really wanted to talk about it. So, we're waiting for that couple that wants to tell their story," she said. "And I'm sure we'll get it."

And so, the operator who answered my call turned to her high-technology promotion system and entered the information I fed her.

Then, with a catch in her voice, she read it back for verification. I told her she'd got it straight. And she said, "Your long lost love has called looking for for you."

"She has?" I exclaimed, shocked.

"Yes," said the operator. "Let me give the call to my supervisor for some additional information."

The supervisor came on and asked for some details about the circumstances that caused my lover and me to separate. I spun a yarn vaguely about college graduation and going separate ways (all on tape so my secretary would tell the same tale). The supervisor said she would call my lost, but now found, former love to confirm that we were, indeed, the correct two people.

After talking to my love, said the supervisor, someone would call and give me her phone number.

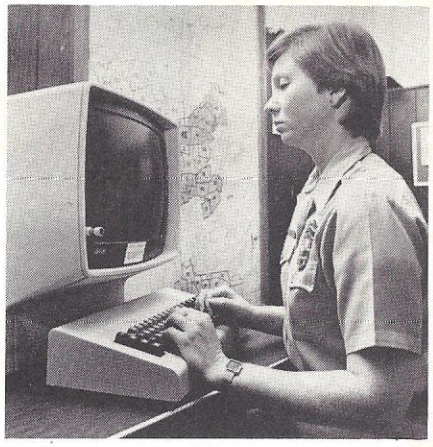
I rushed to my secretary, gave her the tape and details of my tale in case the cupid-playing operators called quickly. I needn't have rushed.

More than a week has passed. I'm still waiting, forlornly but hopefully, for the phone to ring and my long lost love to call and rekindle that old feeling.

— H. Paris Burstyn

Computer Cop

You've heard a lot about computer crime. Now there's a computer "policeman" in San Diego working to solve crimes. The computer predicts which cases are more solvable, saving hours of wasted time.



The Success Prediction Model is just one of the applications of the Automated Regional Justice Information System (ARJIS) being built around an IBM System/370 Model 158 computer. The system, scheduled for completion in 1981, is funded by the federal government and involves 13 San Diego County, CA, law enforcement agencies.

Relevant police information gathered anywhere in the county is flashed to the computer in downtown San Diego. Authorized lawmen in any of the agencies can make inquiries through a network of TV-like terminals connected by telephone lines.

Currently, San Diego police use a computer model to help them determine which burglaries appear most solvable, thereby making optimum use of investigators' time.

Only one burglary in five nationwide results in arrest and prosecution, according to police officials. Therefore crimes with the highest 'solve potential' are investigated first.

When the system is complete, police officers' hand-written burglary reports will be keyed into the computer by clerks seated at terminals. As the information is entered, the computer analyzes variables that determine a case's "solvability".

Then, when an investigator starts his day, he can use the computer terminal to give him a list of recently reported burglaries, ranked in order of their "solvability".

To test the model, information about the hour, season, location and other limited data on 2,200 crimes, including assaults, auto

thefts, burglaries, rapes, robberies and grand thefts, were entered into a computer. The system successfully identified 65 per cent of the crimes that had been solved.

More detailed data on 700 sample burglaries that occurred in San Diego during a six-month-period — including type of place entered, tools used, value of property taken and information about witnesses, suspects and get-away vehicles — also were tested. This time the model was 95 per cent accurate in identifying which crimes had been solved.

ARJIS also organizes crime facts in meaningful ways. Recovered property can be matched with items reported stolen. It can calculate where men and equipment should be stationed and even aid in dispatching patrol cars. ARJIS reports crimes by area, streetname, census tract, status, type of crime, date (or range of dates), victim name, penal code offense, case number and investigative division.

Forgers may have a harder time hiding their true identity if ARJIS is used in the investigation. According to an ARJIS advisor, forgers change their names but tend to keep the same social security number, credit card and driver's license number. The computer records all these identifiers and recalls them with a few strokes on the terminal keyboard.

The system will be valuable for more routine paperwork matters, such as phoned in crime reports and personnel records.

San Diego officials hope to tie ARJIS directly to state and federal law enforcement networks, including customs and the FBI.

Educational Software

Program Design, a group of educational materials designers, is developing educational software for the PET, TRS-80 and Apple II personal computers.

Courses for preschoolers, students and adults come with programs on cassette tapes, printed workbook or guide, and learning materials.

Courses currently available include "IQ-Builder", which develops skills needed to succeed on college entrance exams, civil service tests, and other aptitude tests; "Step By Step", a course in the BASIC programming language; "Preschool IQ-Builder", for 3- to 5-year-olds developing their learning skills.

Other courses to come include algebra, geometry, foreign languages, reading comprehension for children and speed reading. Leisure activities include menu planning, "Know Your Wine", and games.

For information, contact: Program Design, Inc., 11 Idar Court, Greenwich, CT 06830.

Downhill all the way

Imagine travelling from the highest point in the contiguous 48 United States to the lowest point in just one day using only human muscle power. Two scientists at the Naval Weapons Center, Ed Schramko and Tom Kratzke, did it with touring bicycles and a computer-produced contour map prepared at the NWC.

They applied their mathematical expertise and a computer graphics program called DISSPLA to the problem. And last summer they journeyed 144 miles from the 14,495-foot-high peak of Mt. Whitney to 278 feet below sea level at Badwater in Death Valley in 17 hours.

The scientists knew the route they wanted to follow and the program — which translates statistical data into visual representations — helped them to determine where to establish their pit stop sites.

The trip became a part of research into contour analysis mapping now underway for the military. From information on an area in which the terrain altitudes were known, the center's computer, a UNIVAL-1110, produced a cross section of a ground contour in terms of altitude and distance. Water stops were scheduled according to the grades which would be encountered.

The map, which Schramko said will allow other cyclists to plan stops according to their own abilities, is available from the Lone Pine Chamber of Commerce, P.O. Box 552, Lone Pine, CA.

Computer Operator?

Credit card callers in Illinois may find themselves talking to a computer instead of an operator. Illinois is the first state in the nation to implement a telephone control system with word recognition for people making credit card calls.

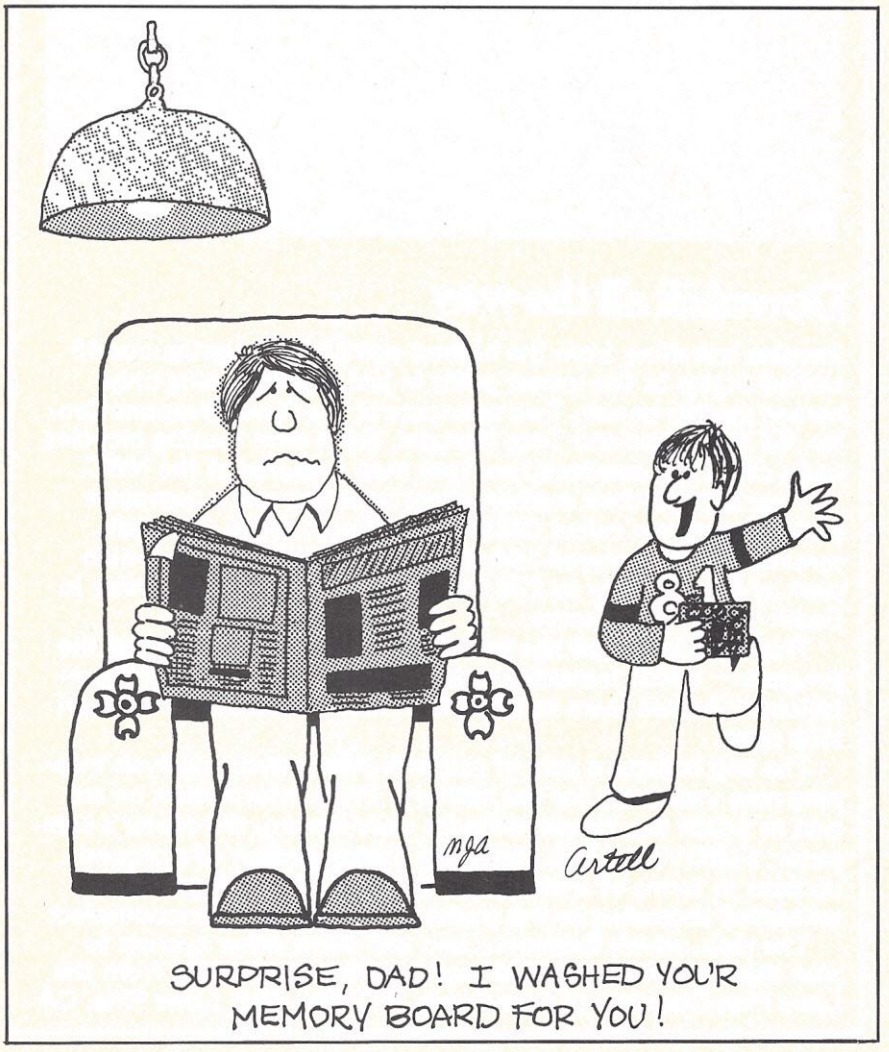
Director Ted Puckorius of the Department of Administrative Services (DAS) said the main goal of the new system is to reduce the cost of credit card calls, which currently cost the state $42,000 per month. The new system will reduce this cost to $23,500 per month, a savings of over $200,000 per year. The new system was developed in conjunction with Action Communications System of Dallas, TX, and Dialog Systems of Belmont, MA.

According to Puckorius, the 100 credit card holders currently using the system are mainly inspectors for the Department of Agriculture. When the system is fully operational in July, 4000 state employees will have access to the computer.

Under the system, a caller dials the central state credit card number. This places the caller in contact with the computer which verbally instructs him to read an eight-digit credit card number into the phone while the computer listens. The computer reads the eight-digit number back to the caller and asks if it is correct. If the caller answers "yes" the computer checks the number, and if it is valid, asks the caller for the destination number.

Should the computer read back an incorrect credit card number to the caller and he answers "no" when asked if it is correct, the computer asks the caller to read the number again. Once the credit card number is correct, the computer asks the caller for the destination number. The caller reads the number one digit at a time, and the computer repeats each number to the caller as it is read. Should the computer misinterpret a digit, the caller may say "no", and the computer will ask the caller to repeat that digit before going on to the next number. Once the destination number is correct, the call is put through on a state line while the computer records all the pertinent data.

A feature of this system, said Puckorius, is that in the event of an error, by the caller or by the computer, the computer assumes it made the error and asks the caller to repeat the number. If, after three tries, the caller has failed to give a correct number, the computer hangs up, and the caller must try again.



SURPRISE, DAD! I WASHED YOUR MEMORY BOARD FOR YOU!

Are 16 bits better than 8?

For those personal computerists who are undecided over the choice of an 8-bit or a 16-bit computer, Heath Company offers a free brochure entitled "Why You Should Consider A Sixteen-Bit Microcomputer".

Besides the 16-bit computer's advantages and the 8-bit computer's limitations, the brochure also covers computing power, software, service, support, reputation, quality and reliability.

Included also in the brochure is an introduction to the H11 Computer, Heath's 16-bit machine that utilizes the Digital Equipment Corporation LSI-11 CPU. The H11 is available both in kit form and as a completely wired and tested unit fully compatible with most DEC accessories and peripherals.

For a free copy write Heath Company, Dept. 350-650, Benton Harbor, MI 49022.

Business Computing Primer

Computer Concepts for Small Business, a self-instructional course for first-time computer users, has been announced by INFO 3, publishers of audio-cassette EDP courses. The course covers basic computer concepts, including data type and processing, development of systems, the operation of implemented systems and computer selection.

Goals, objectives and tasks for this course are shown on a chart which is available for free.

Designed to help business people prepare for their first computer, the course presents the prerequisites of sound business computer applications, shows how systems are developed and operated and covers critical management decisions such as security and personnel staffing. Specific steps are described for evaluating and acquiring computer equipment and software.

Over two hours of instructional audio-cassette tapes are included in the course plus a 200-page workbook. Course price is $140.

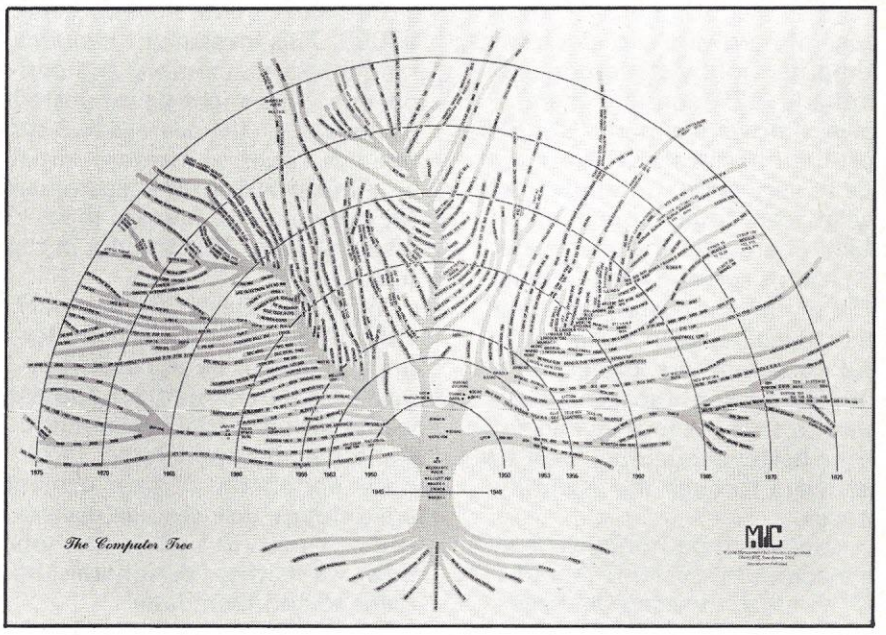
For more information, contact INFO 3, 21241 Ventura Blvd, Suite 193, Woodland Hills, CA 91364. Toll-free number is (800) 423-5205; in California, (213) 999-5753.

Exam Dates Set

The next offering of the Certificate in Computer Programming (CCP) examination will be December 9, 1978, according to the Institute for Certification of Com-Computer Professionals (ICCP). The Certificate in Data Processing (CDP) examination will be offered on May 5, 1979.

ICCP is a non-profit organization for testing and certifying knowledge and skills of computing personnel. At the present time, 18,681 people have been certified by the Institute.

For more information, write to ICCP, 35 East Wacker Drive, Chicago, IL 60601.



Computer family tree

Management Information Corporation has created a computer family tree which follows the growth of the data processing industry over the past 30 years. Beginning with the Mark I, the tree branches out to link together each successive generation, forming a con tinual structure.

This 18" x 24" poster names each model and the year it was introduced. It is available for $10 ($15 outside the United States). To obtain a copy, send your name, company name and address, along with a check or money order payable to Management Information Corporation, to MIC, 140 Barclay Center, Cherry Hill, NJ 08034 or call (609) 428-1020.

Profile of Computer Hobbyists

To better understand computer hobbyists, Heath Company recently surveyed its users, obtaining the following result.

Of its users, nearly half (46%) are between 25 and 34 years old, and another quarter from 35 to 44. Those under 25 (12%) probably lack the financial resources and time to pursue the hobby. Those over 44 (17%) seem to have reached the point in life where they no longer want to learn a whole new field.

Educationally, as you might expect, computer hobbyists are better educated than the general public; about 2/3 have an undergraduate or graduate college degree, or have done some graduate work.

A large percentage of computer hobbyists work at the professional level. 26% have a computer-related job; 31% are engineers or scientists and 7% are technicians. Thus, a total of 64% (almost 2/3) of those interested in computers as a hobby either work with computers during the day or have a strong technical background. 23% indicated other occupations box — almost any occupation has at least one computer hobbyist.

People interested in Heathkit compters were asked to rate their knowledge of software and programming. Only 11% consider themselves expert. 45% feel they have average to very good software knowledge, but 44% feel their software skills are mediocre or worse. If you think you have a lot to learn about software, welcome to the club. You are not alone. *(Continued on next page)*

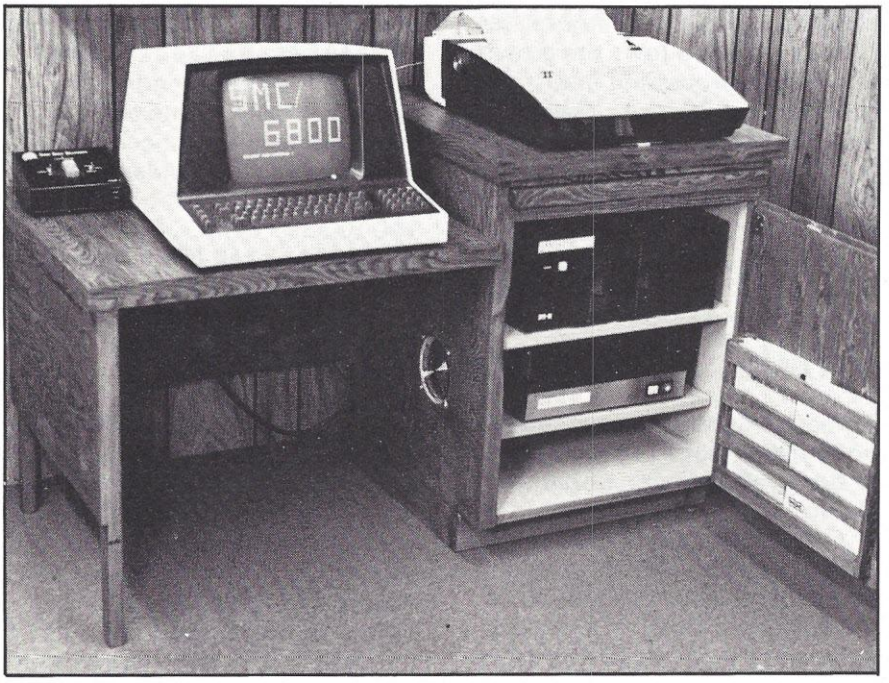
Also asked to rate their knowledge of hardware and electronics, computer hobbyists responded similarly; 12% consider themselves hardware experts. But 68% feel their hardware skills are average to very good. Computer hobbyists seem to be more comfortable in hardware than software.

Heath's survey revealed that 80% of current customers, given the choice between assembled and kit computers, prefer the kit. The two reasons most mentioned were to save the money and to become better acquainted with the hardware through the assembly process.

How much do hobbyists invest in a computer system? About 60% of them had invested between $1000 and $3000. 20% exceeded $3000. This investment includes random access memory and peripherals. You might be interested to know that the average H-8 system has 13.3K of memory initially. Almost 70% of H-8 customers say they plan to increase their memory from 32K to 64K in the future.

What peripherals are popular? Other than tape I/O, a video terminal seems to be the most popular peripheral, one the hobbyist wants for his initial system, not something he wants later. Two other peripherals in great demand are a floppy disk storage device and a printer. But while the hobbyist wants these peripherals, he plans to add them later.

Desk for your system



Need a place for your computer system? A custom built all-wood desk is now available featuring a split level 55" x 26" top with walnut grain formica. The upper level is 26" x 26" and the lower level is 30" x 26", placing the keyboard at elbow height. Under the printer area is a 23" x 23" x 24" compartment with two adjustable shelves and a door opening of 21" x 23". Standard finish is walnut stain. Options available include right or left hand design, other finishes and tops and minor variations in dimension sizes. Desks are built to customer's requirements.

Basic price of the desk is $295. For details and ordering info write to Stephen Moe Company, P.O. Box 595, Springfield, OR 97477; tel: (503) 726-7613.

If your system now sits on the corner of the kitchen table, consider a desk such as this one.

Software Exchange

Software Exchange is a new publication promoting the exchange of software in the small computer marketplace. This bi-monthly magazine will be available soon at computer stores for $1.50 per issue and by subscription for $8 per year (six issues).

Software Exchange provides reviews of user's groups, software packages and consultants working with small computers. Each program has a description of its operation, hardware requirements and a list of where materials can be obtained.

People with software to sell, trade or buy can place classified advertisements in The Software Exchange for a $2 fee.

For more information contact The Software Exchange, Box 55056, Valencia, CA 91355.

NCC '79

NCC '79 will be held June 4 to 7 in New York City and will feature a separate Personal Computing Festival. The exhibit program will occupy all four floors of the New York Coliseum, and program sessions will be held in the New York Hilton and Americana Hotels. The Personal Computing Festival will take place at the Americana.

Other features of NCC '79 include professional development seminars and featured addresses.

Conference chairman of the 1979 National Computer Conference is Merlin G. Smith of IBM's Watson Research Center.

Texas Instruments at Winter Olympics

Texas Instruments will supply electronic technology to the 1980 XIII Olympic Winter Games in Lake Placid, New York. The electronics will form the foundation of a computer/terminal network at the Winter Games site. The network is called

the Texas Instruments System for Computerized Olympic Results and Events (TI SCORE).

TI SCORE will comprise Model 990/10 computers, Series 700 intelligent terminals, Model 810 printers, as well as other terminals, peripherals and software. Handheld programmable calculators will also be used to quickly compute scores, at each sports site.

The network will link the nine event sites and five other strategic locations within the Olympic Village to provide event-competition results to judges, officials and to broadcast and press centers. It will also support the Winter Olympics' press registration and accreditation as well as housing reservations.

At each of the event sites each day of the Olympics, competitive results will be entered into the computers through intelligent terminals at event locations. Event judges will receive a list of current standings as well as the next participating order for each event. The same data will be available on an inquiry status to other terminals throughout the Village.

At the end of each day, total competitive results will be printed out and carried in the Olympic Games daily newspaper. When the Winter Games come to a close on February 24, all sports results in the TI computers will be printed out and used to produce, within 24 hours, an official 1980 Winter Olympics results book.

Books, books, books

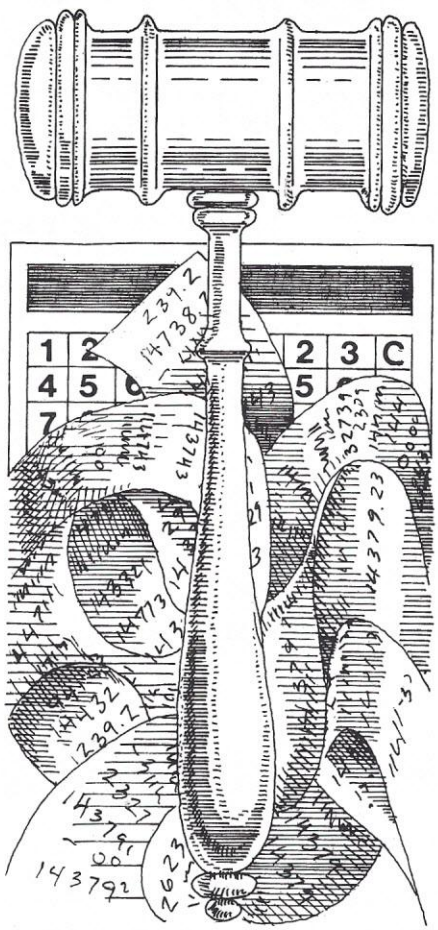
Over 125 computer-related titles with summary and price, from over 15 publishers, are listed in the *Master List of Computer Books*. This new catalog is divided into five sections — Introduction To Computers, Microprocessors/Microcomputers, Hardware, Software — Machine and Assembly Language and Software — BASIC.

The catalog is available for $1.50 postpaid from The Computer Bookstore, 796 Navy Street, Ft. Walton Beach, FL 32548.

Programmable Perry Mason

Perry Mason had Paul Drake and Della Street. Malcolm Misuraca had his pocket calculator.

Misuraca, a Santa Rosa, CA, attorney, used his HP 65 pocket calculator for years as a navigational aid in his hobby, small aircraft flying, but never considered that the calculator could help in legal matters until he faced an important court case in Reno, NV, involving the appraisal of a trailer park.



A large number of property appraisals are made via a complex calculation, the Ellwood equations, involving variables on profit earnings, sales fixed assets and other factors. Traditionally, finding solutions to these variables demanded hunting through a weighty volume of tables. The idea of scrambling through one of these books in a crowded courtroom every time a new value was offered up did not appeal to Misuraca, who knew that a jury often reacts unfavorably to dull, time-consuming presentation.

Misuraca wondered whether his HP-65 could compute the equation and called Hewlett-Packard to ask about the program. Yes, said HP, there already was a program developed to compute the equation; however, it was designed for the HP-67, the more powerful replacement for the HP-65.

Arrangements were made, and as soon as Misuraca stepped off the airplane in Reno, a local HP field engineer handed him a program listing.

"I spent the entire night reworking the program," said Misuraca. "Designed for the HP-67, it used about five more program steps than my HP-65 could hold — which meant I had to create enough short-cuts to make those five steps fit.

"The next day, I felt very smug about what I had done — a secret weapon hidden in my briefacse. I called the county assessor to the stand and asked him a few questions. When we entered the area of alternate assessments, I fed the magnetic card into my calculator and prepared to dazzle the jury. But, as soon as I pulled out the HP-65, the assessor motioned to one of his assistants, who pulled an HP-97 (a printing version of the HP-67) out of *his* briefcase!

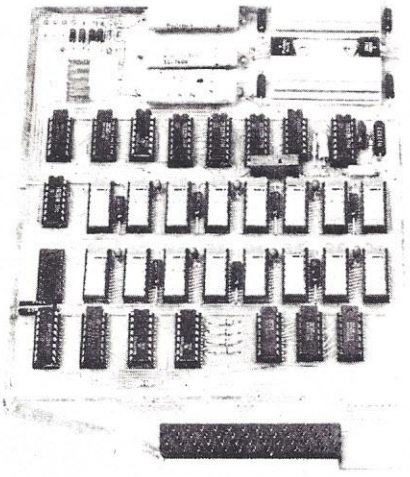
"The result was a battle of the calculators. I would suggest a rate, and the two of us would punch it into our respective machines. Since the assistant's model had a printer, it would take a little longer to achieve a result. So, I would announce an assessment, there would be a one-second pause, then the assistnat would say, 'Correct.' This went on for quite a while — with one member of the jury laughing uproariously the entire time. It seems that he was the director of the computer center of one of the city's big casinos."

Misuraca won the case. His methods might best be described as — ahem — calculating.

Illustration by David Gardner

PET PERIPHERALS

(All Fully Assembled)



NOTE: Peripherals above are NOT Commodore products.

One-Way Serial Interface ($169) Allows you to obtain hard copy printouts using any standard RS-232 serial printer (IBM, Diablo, Teletype, GE, etc). Specify printer and baud rate needed!

Two-Way Serial Interface ($295) Allows your PET to communicate both ways with any RS-232 Terminal. Baud rate set on board from 75 to 9600 bps. From 5 to 8 character bits with mark, odd or even parity! Complete with all necessary cables, connectors, and case.

Two-Way/Two Channel ($335) Same as above, plus ability to daisy chain another peripheral on same board.

Modem ($375) Auto Originals/Answer (Software Selected/enabled). Baud rate of 75 to 600 bps. Directly compatible with "CBT" type equipment available from phone company. For "CBS" type equipment, add $10. Complete with cable and case.

S-100 1-Slot Expansion Interface/Motherboard ($105) Allows the use of any S-100 board to be interfaced to PET. Requires power supply ($39).

S-100 4-Slot Expansion Interface /Motherboard ($160) Allows the use of up to four S-100 boards. Requires power supply ($39).

Get your PET up to 32K
with PME – MEMORY EXPANSION
for ONLY $595!!!

- Mounts easily inside your PET chassis
- Uses your PET's transformer without degradation of your system
- Full 6 month limited warranty
- Full manual with graphic display memory test that shows chip layout

FROM NATIONAL CORPORATE SCIENCES, INC.: *(For PET)*

SUPER STARTREK: Add some excitement to your Klingon warefare! Our version of Startrek includes action, in addition to the "standard" Startrek features. Follow the action as you maneuver about the quadrant! See your photon torpedo seek out and destroy the enemy! Watch your starship dock at a starbase to resupply and effect repairs! With our Startrek, your missions are never dull! Long live the Federation! Reg. $19.95 **Special Offer – $9.95**

SWARM: Huge Swarms of killer bees have been sighted in various sections of the U.S. They are spreading at an alarming rate, causing thousands of casualties. All the resources of the U.S. (and all its hopes, too) have been placed in your care. You must decide the tactics to be used to combat this deadly menace. You must oversee all 21 sectors of the U.S. and prevent the major city in each section from being overrun by the swarm. Using various combat and urban defense tactics, combined with evacuation and nuclear destruction, you attempt to save the U.S. from the deadly menace of... SWARM! Reg. $24.95 **Special Offer – $14.95**

NEW PET PRINTER!

The word is out .... The PET INTELLIGENT IMPACT PRINTER WILL HIT THE MARKET SEPT/OCT 1978!!!

SPECS: 60 characters per second . . . . . 8½ roll, fanfold, or cut page paper . . . 80 characters per line . . . 7 x 8 dot matrix characters . . . full formatting and forms capability . . . makes up to 4 copies simultaneously . . .
Yes! Prints all PET graphic characters, too!!!

To ensure the fastest delivery possible, just send a $25 reservation deposit. This fully-refundable deposit will reserve you a prime spot in the sure-to-be mad rush for PET PRINTERS.

Only $695

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"History is the rear-view mirror of progress"

LOOKING BACK

BY HENRY BRAINERD

It was a rainy day in July. The sun had disappeared behind some black clouds a few days ago, and was not seen since. Even the birds that whistle and eat at the same time, producing a natural zoological phenomenon, had disappeared. It was as gloomy a day as any I have experienced and therefore it was with a good deal of expectation that I received a phone call from my friend Lank Siggerson. He was quite excited. He had two free passes for the Science Museum and would I care to join him? He is pretty generous in matters such as these although he has yet to treat me to a cup of coffee, always managing to disappear as soon as the check arrives. The reason Lank invited me was the museum was having an exhibition of textile machinery. I have a great interest in this field because I used to lecture on how the modern-day computer really had its origin in the looms of the textile machinery.

"How do you figure that?" he always would ask me whenever I mentioned it.

Usually I had to repeat it several times over before he would tell me to shut up. See, the thing about Lank is that while he's listening to you, he is building bridges in his mind.

In any event, I met Lank in the lobby of the Science Museum where he was slouching on a wooden bench and munching happily on a chocolate bar. I walked over to him and greeted him with the comment that why the devil didn't he call me on pleasant days. Personally, I prefer to stay home and do my research on these gloomy, depressing days.

Lank snatched my extended hand and wrapped his big mitt around it, like he had just caught an earthworm and was squeezing it to death.

"Whatcha eatin'?" I asked as I retrieved my hand from his grasp and shook it in the air to get the circulation going again.

"Chocolate. Good for you. Especially days like this. Dextrose gives you energy, life, vitality. Rotten weather we're havin'. Here, have a piece of candy. Do you some good." He thereupon pinched off a small corner of the candy bar and handed it to me.

"My dear man," I sneered. "I have cavities in my teeth that are bigger than this piece of candy. You sure you want to part with it?"

"You should've come earlier. Been waiting half an hour. Had more candy to share then. Have you noticed the weight in these bars now? Look at this label. Contains 32 grams. Now you would think that that was a lot of candy for your money. People tend not to look beyond the first digit usually. So they get 32 grams for 15 cents and 32 grams is about 1/16th of a pound. In other words 16 of these bars would make a pound. But no, they gotta hide behind the metric system. I say that in matters of food the government should stick to the English system like pounds and feet and leave that metric system to the sciences. If this candy bar had said 1/16th of a pound, do you think I'd be sucker enough to buy it? Hardly. But 32 grams sounds like a good buy. Anyway, the way the candy is shrinking and the way the prices keep going up, you'll soon find yourself paying 15 cents just for an empty wrapper inside of which you'll find only a colored picture of the candy bar. That's where inflation is taking us. So eat that piece of candy and thank the good Lord for the little things."

"I see you're not in your best mood today."

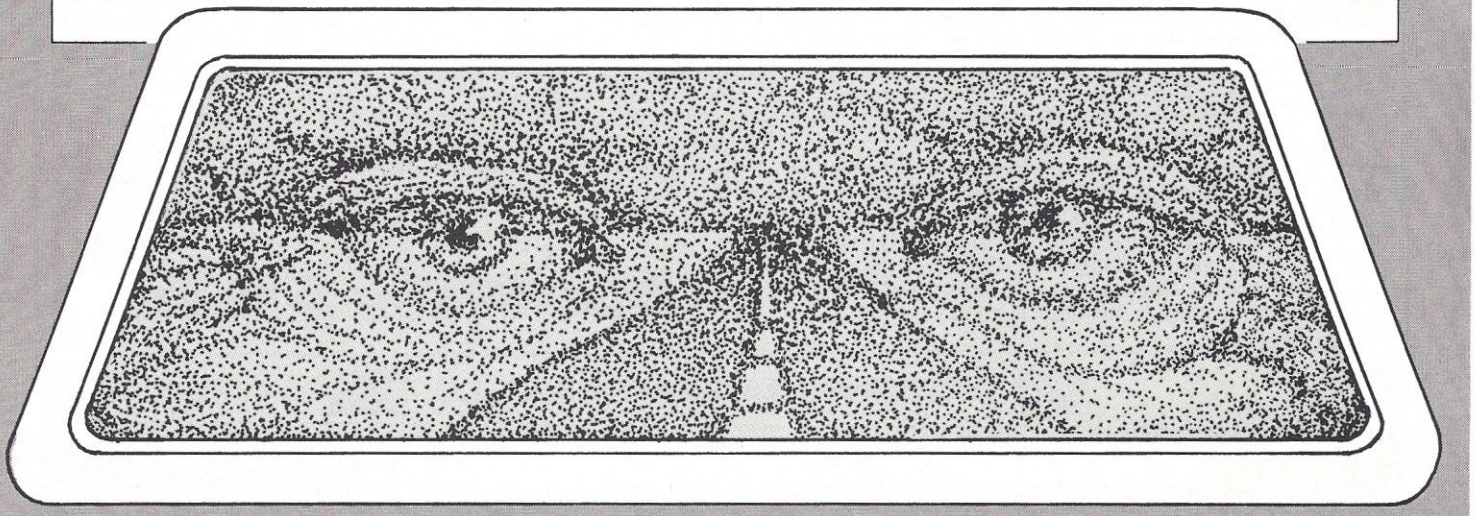


Illustration by Nancy Lawrence

APPLE II SPECIALS

VOICE CONTROL

The Apple II, known to date for its unique color graphics, has been party to the most far-reaching computer development of the late 70's . . . ON/OFF VOICE CONTROL!

HEURISTICS and MOUNTAIN HARDWARE, following many years of development, have just introduced low-cost voice-recognition and controller systems — designed specifically for the Apple II.

The Speech Lab by HEURISTICS . . . complete with board, microphone and programs. Recalls 32 Spoken Words.

Your Apple II can react to your own voice command!!!

The Introl by MOUNTAIN HARDWARE . . . complete with board, demo tape, and manuals. Ability to control two AC outlets. No extensive wiring needed. Utilizing your own AC lines.

The Computer Factory has configured the Dream System Speech Lab and Introl, alongside your Apple II, gives you a taste of the future, now. Who knows what's next!!!

APPLE II 16K	$1,195
HEURISTICS SPEECH LAB	189
MOUNTAIN HARDWARE CONTROLLER	189
INTROL	149
sugg. mfg. retail	$1,722
OUR PRICE $1,572	
SAVE	$150

PERSONAL

Our Special Personal System includes Apple II's Disk II. Disk allows quick storage and easy access to files and large quantities of data, for both home and business use. Speeding up load time and data retrieval, the Disk adds flexibility.

For home use, Expandor's Impact Printer is undoubtedly the best value on the market today. Full 80 column printer . . . . 8½ inch paper . . (NOT thermal).

APPLE II 32K	$1,495
DISK	495
PRINTER INTERFACE	218.75
EXPANDOR PRINTER	425.95
sugg. mfg. retail	$2,634.70
OUR PRICE $2,395	
SAVE	$239.70

BUSINESS

There is only one word to describe our business package. VALUE! 48K Apple II . . . . Dual Mini Floppy Disk Drives, yielding approximately 240K bytes of storage. Centronics 779 Printer . . . . 80-132 columns (adjustable). . . .60-110 cps . . . . perfect for all business forms . . . . multicopies . . . 5 X 7 dot matrix.

Just think. A Dual Disk Business System for only $3595. Now that's something special!

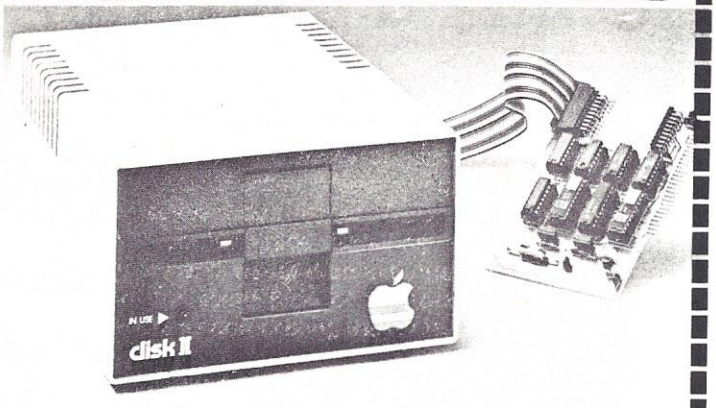
APPLE II 48K	$1,795
DUAL DISK	990
PRINTER INTERFACE	180
CENTRONICS 779 PRINTER	1,175
sugg. mfg. retail	$4,185
OUR PRICE $3,593	
SAVE	$590

APPLE II DISK

A major development in the personal and small business market . . . Best of Both Worlds. . . Mass Storage Like The Main Frames at the Cost of a Micro!!!

116K per Disk. . . full READ, WRITE, and SAVE commands and full disk operating system!

INTRODUCTORY PRICE — $495
while supplies last



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BANKAMERICARD LEASING AVAILABLE

"It's the weather, Hank. Anybody who walks around in weather like this with a smile on his face deserves to be arrested and questioned. Chances are he's committed a crime."

"Well," I said as I swallowed the birdseed-sized candy. "Let's get over to that textile loom. Anxious to see it. I've told you how the computer got started from these looms, haven't I?"

"About 4 or 5 times."

"Remember anything?"

"Can't say that I do."

"Well, I'll tell you about it once more. You know they're talking about transplanting memory chips into brains to cure senility. You ought to look into it. Could increase your memory size by a couple of kilobytes."

Lank aimed a kick at me which I succeeded in dodging. "Now don't get uppity with me," I said. "It's okay for you to pull your scrawny jokes on me. But when I try it you get mad."

At that point we left the lobby and took the elevator to the third floor, where the textile machinery was on exhibit.

"The origin of the computer," I said to Lank as we started to walk around the roped-off area inside of which stood the big, antique textile looms, "lies right there in the heart of the loom. That is the origin of the computer. Same way as the origins of Edison's inventions lie in the early works of scientists like Michael Faraday, Andre Ampere and Count Volta."

"How do you figure that?" he asked. I told you that he asks the same question over and over.

"Well," I said, "that is where the first punched cards to be successfully used in commerce appeared. And those punched cards, my dear you-know-it-all friend, marks the beginning of the computer era."

"Well, I don't see any relationship. You're trying to tell me that the cart is related to the horse because they're both hitched together."

"Pay attention to me," I said. I began to point out various features of the looms on exhibition. "See those lengthwise threads in the cloth? That cloth must be a good 50 yards long."

"That's how they used to weave cloth in the old days. I know that much. And they still do, today."

"All right," I told my long-legged friend. "Those lengthwise threads are called warp. W-A-R-P!" I spelled it out quickly for him before he had a chance to pull an ethnic joke on me. "The threads unreel slowly from a roll at the back and the woven cloth rolls up at front. A frame – notice that wooden overhang on hinges." I pointed. "Well, that frame would be lifted by cams in place and bring with it half the warp thread. Then, wham! A blow from a mallet, driven by another cam, would whack a shuttle across the room, leaving a crosswise thread called the woof. Years later I heard the modern term was 'weft' or 'fill'." A group of school kids had by this time latched on to us and were following us around as we circled the exhibit. They must have thought I was a tour guide. I don't mind kids. Enjoy having them listen to what I've got to say. Makes me feel I'm contributing something to their education.

"Then," I continued a little louder for the benefit of the kids, "after the shuttle went across the whole length of the loom, a comb would push a new thread against what was already woven, the frame would drop back in place, a second frame would lift the other half of the warp thread and the shuttle was driven back again. Sometimes, the noise these mallets and shuttles were making, you'd think you were at a croquet game with everybody banging at the same time. Ever play croquet?"

"Just golf," said Lank. "Croquet's too dangerous. Heard tell of a croquet player who got a big wooden ball rammed up against his rear end from somebody's mallet. A woman, too. I think he sued her in the English court but the barristers threw the case out. They said croquet players should know by experience that when they walk forward, their heads should always be turned backward."

"I suppose," I said. "Anyway, what I'm getting at was this one loom, called the Jacquard, that could weave the most elaborate patterns you ever saw. Somewhere in its looms it had punched cards, each the size of a magazine cover, laced or hinged together in sort of a Z-fold strip."

"Had punched cards way back then, eh?"

"They sure do go back a long ways. My father, who liked to explain everything to me, said that each warp thread would be lifted individually and that the cards controlled which ones to lift in order to create a desired pattern. But I couldn't figure out how the pattern was coded. And I've had those Jacquard cards in my hand. The holes looked almost as if they were positioned at random and appeared to have no relation to the pattern."

"Now what in tarnation does that have to do with computers?" asked Lank, which was the subject we always got locked into whenever we met.

"Well, I got the answer to that more than half a century later. Funny how some things linger in your

"You know they're talking about transplanting memory chips into brains to cure senility. You ought to look into it."

memory. I attended the 1977 meeting of the Society for the History of Technology. I happened to hear a paper read there that told how Joseph Jacquard, about 1800, developed punched cards to control his loom and 30 years later Charles Babbage got the idea from Jacquard and used it to input numbers for his calculating machine."

"You know, Foureyes," said Lank, turning to me, "I understand that Harvard has a part of Babbage's machine still floating around somewhere."

"Well, I heard that too. Someday I'll go down and find out what it's all about. Want to come along?"

"It depends on how my garden is doing."

"The way those cards work," I told Lank, ignoring his remark, "is that each thread of the warp has a lifting wire called a heald. Each heald has a hook at the top and is linked to a light horizontal rod. The punched card is pushed against the ends of these rods and pushes the healds a short distance except where the rods go through the punched holes. Then a cross bar lifts all the hooks that haven't been pushed out of line."

"You sure you got that straight? Sounds gobbledegook to me."

"Yes, it's straight. The cross bar lifts the warp threads that correspond to the punch holes in the cards."

I grabbed a blank piece of paper lying on the floor and drew a sketch so Lank could see what I was talking about.

"When the card is pushed over it pushes the rod and that pushes the hook"

"Lot a pushin' goin' on. Sounds like a subway ride."

I ignored Lank. "Where there's a hole, it doesn't push the rod and the hook stays lined up with the lifting bar."

"Why not have the card lift the healds directly?"

"It takes a fair amount of force to lift each heald and that would wear out the cards pretty fast," I told Lank. "This way the rod is hardly more than a feeler – puts very little force on the card, doesn't wear it out."

"That makes sense," said Lank. "But what about the pattern of holes that don't seem to relate to the weaving pattern?"

"I never followed through on that," I said. "My best guss is that there are a couple of dozen horizontal rows on the card so that there can be enough positions for all the warp threads. Figuring how this makes the pattern is like watching bit streams on a scope and trying to guess what'll come out of the computer's printer."

"Well, why didn't you say so in the first place."

"That's exactly what I said. You listening to me or not?"

"Don't get finnicky. You just keep on talking. Whether or not I listen is my business."

"Now, if you're weaving a pattern of colors you have to use several colors of woof thread, too. Them textile engineers were pretty smart fellers. There was a shuttle for each color and a few extra punch locations to control which one would line up with the mallet."

"I still don't get your punched-card theory. Can't seem to relate that to the computer."

"History is never straightforward," I continued. "The man who invented punch cards was Herman Hollerith and he never even heard of Jacquard or Babbage."

"So you think punched cards started with Hollerith?"

"Well, recently I dug way back and found that Hollerith got *his* idea of punched cards from a form of railroad ticket in which, to prevent fraud, the conductor punched squares that showed passengers' descriptions – man or woman, tall, medium, or short, color of hair and eyes."

"There's that old saying," said Lank. "Nothing new under the sun."

"This all took place in the 1880s. Fifty years after Babbage. He had worked on the hand tabulation of the 1880 census and by 1890 he came up with punched card machines that did the job many times faster. What would have taken years by hand methods was finished in months by two shifts of a hundred people each punching cards and feeding them one at a time to the machines."

"Certainly moving forward. Bet he was a good card player," said Lank with a grin.

"Hollerith," I continued out loud, ignoring Lank's wisecrack, "went on to supply machines for census tabulation to many other countries and to develop them for business use. In 1911 he sold out his company and retired. In 1924 the new owners changed the name to International Business Machines Corporation (IBM)."

"To say that today's successor to Hollerith is well known," interjected Lank, "would be an understatement."

"I was just going to say that."

"Well, why didn't you? 'Stead of gabbing, why didn't you just come out and say what you meant?"

"Just one more thing I gotta say," I told Lank as we headed for the door. "Not everybody realizes that Jacquard was the world's first programmer. He punched his cards, inserted them into a machine and the machine went right on performing the tasks that were contained in the instruction of punched-out holes."

We were at the door of the museum now, back in the mist and gloom of the depressing day.

Suddenly Lank stopped and said: "What's that you were saying about textile machinery?"

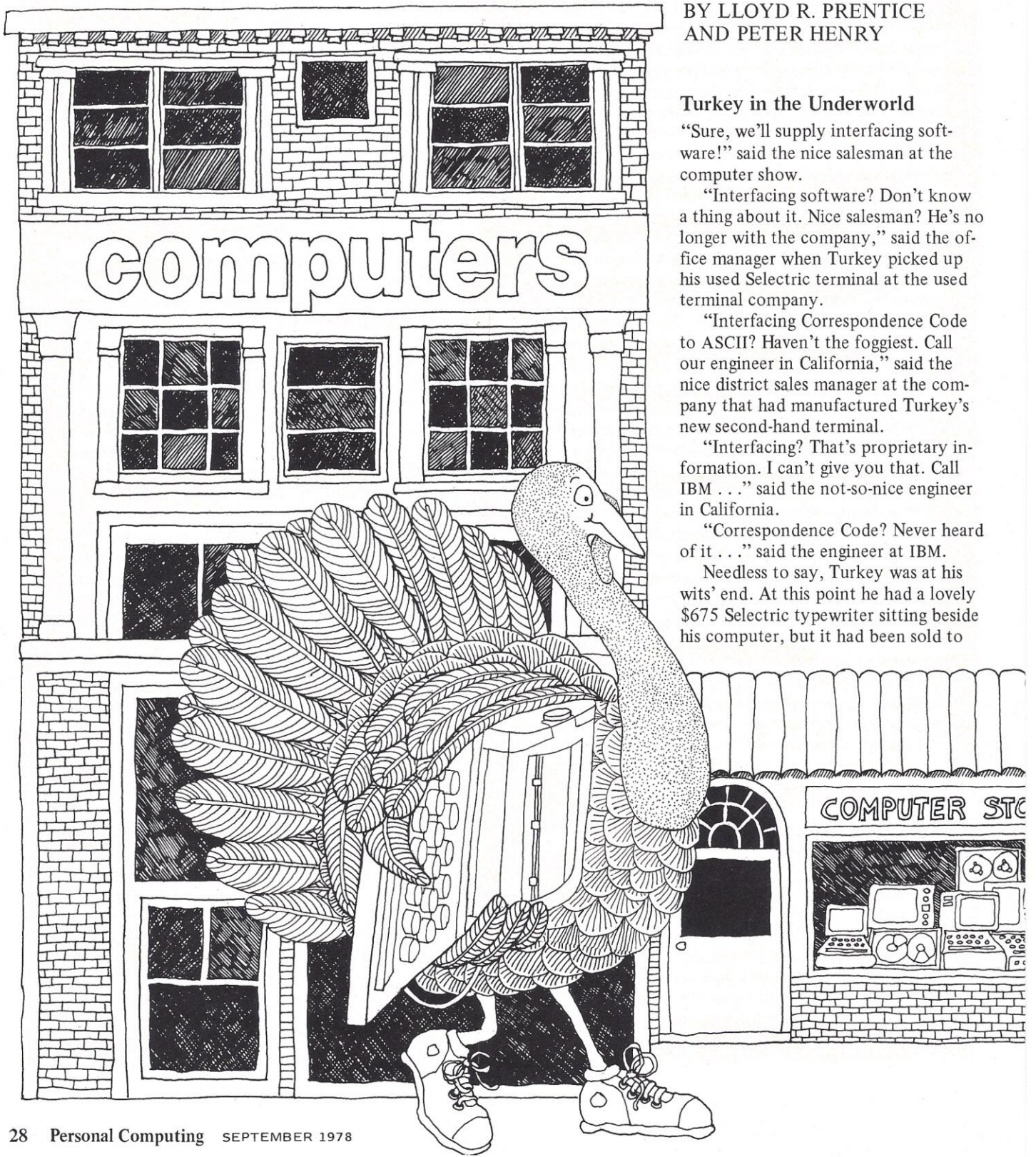
I looked at my friend. He obviously had been on one of his mental trips out to the stars someplace and has just returned. "Nothing," I said. "Have a nice trip?"

"Fine," he said. "Listen. I may have a few free passes for the Harvard museum. Gotta take a look at those parts of Babbage's machine there. Interested in coming?"

"Sure. If you pick a pleasant day."

With that we shook hands and parted, having closed one more chapter in the history of computer development. □

Techno Turkey and his Electric Selectric



BY LLOYD R. PRENTICE
AND PETER HENRY

Turkey in the Underworld

"Sure, we'll supply interfacing software!" said the nice salesman at the computer show.

"Interfacing software? Don't know a thing about it. Nice salesman? He's no longer with the company," said the office manager when Turkey picked up his used Selectric terminal at the used terminal company.

"Interfacing Correspondence Code to ASCII? Haven't the foggiest. Call our engineer in California," said the nice district sales manager at the company that had manufactured Turkey's new second-hand terminal.

"Interfacing? That's proprietary information. I can't give you that. Call IBM . . ." said the not-so-nice engineer in California.

"Correspondence Code? Never heard of it . . ." said the engineer at IBM.

Needless to say, Turkey was at his wits' end. At this point he had a lovely $675 Selectric typewriter sitting beside his computer, but it had been sold to

him as a computer terminal – a GTE Information Systems Novar 5-41 terminal, to be exact – and a computer terminal he was determined to have. The only catch was that the Greeks weren't speaking to the Romans, so to speak – that is, his TDL Z80-based computer spoke nice civilized ASCII and the terminal spoke some barbaric tongue called Correspondence. What to do? What to do?

If the high priests of technology couldn't (or wouldn't) help him, Turkey decided, then he had to help himself. But where to start? The first step, he reasoned, was to find a "Rosetta Stone". The ASCII was easy since every computer book ever printed seems to have its obligatory ASCII table in the appendix. But Correspondence Code?

At this point a few write only memory cells decided to read for a change and the name Don Lancaster flashed down the bus to the central processor. Turkey thumbed through *TV Typewriter Cookbook* and behold! There it was! ASCII to Correspondence conversion! But wait . . . It showed Correspondence as a parallel code, and his handy-dandy Novar expects its bits to come marching in one at a time – tra la, tra la. But in what order? And what about baud rate and start and stop bits and all them nice things that Turkey'd tried so feebly to program into his brain during his perusals through the primers?

One fine Saturday (actually it was raining) found Turkey rummaging from floor to ceiling, up one flight and down another, through the labyrinths of MIT's Barker Engineering Library. There were IBM manuals galore. Even a few Correspondence tables popped out of the pages, but these were all of the same stripe as Lancaster's *bon mot* – parallel code with nary a hint about serial communication in the lot.

Oh, despair! Turkey was fully convinced that at least 2,743 computer geniuses on the MIT campus could clear up his troubles without so much as a break in stride toward the coffee machine, but no one seemed remotely interested in talking with a technological turkey like him – the one he approached could bearly bring himself out of his Fourier analysis long enough to give Turkey a blank stare and mutter something about trying to sell a used slide rule.

"I've got to be logical about this," Turkey decided.

He swallowed his pride and dialed the one number he'd vowed by Babbage's beard never to dial again – the computer store that sold him his system. What did he have against the computer store? For one thing, the phone was always busy – a fact that cost him a $7 cab ride on one of those 27 days on which his system was supposed to be ready but wasn't. He later discovered, after he'd put at least one cab driver into an upper income bracket, of course, that they often left the phone off the hook at the computer store so it wouldn't bother them while they were working. Further –

Wait, let's play back the tapes and you can hear for yourself what Turkey was up against.

"Hello, computer store?" (Don't ask me how he got through. It just happened.) "Computer store? Remember me? I bought that $2400 computer system a few months ago? Yes, yes, I'll hold . . ."

The man at the computer store didn't remember Turkey, of course – never did when he called. Turkey waited for the line to stir to life again. It was quite a wait.

"Computer store? Remember that zippy system that was supposed to do word processing and all those other nifty things – you know, the one that was supposed to take three weeks to deliver, but took nearly four months instead?" (Slight pause.)

"No, no, you must have me mixed up with someone else. The name is Turkey . . . T-U-R-K-E-Y." (Another slight pause.)

"Yes, yes, that's me – It's working quite fine, thank you, except the keyboard sticks so I get a screen full of As at the drop of a hat . . ." (Still another slight pause.)

"No kidding! They really wear out in three months? That's amazing! You mean I'll just have to buy a new keyboard every three months, eh? They just don't make things the way they used to, do they? Well, anyway, that's not why I'm calling. . .

"Remember we talked about interfacing a used Selectric terminal before I put down the payment for my computer and you said that it would be no problem? Well I've got the terminal and it's a problem and now I need your help . . ." (And yet another slight pause.)

"You want me to hold while you check with the technician . . . "

At this point Turkey was actually quite heartened, believe it or not, be-

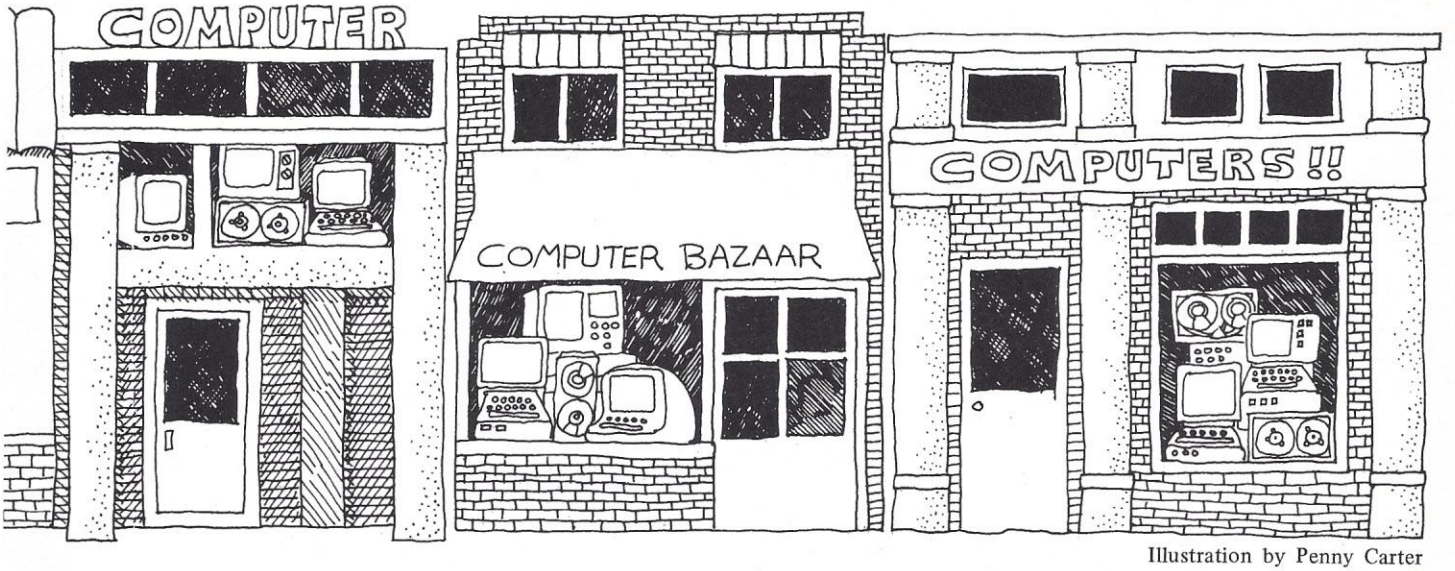


Illustration by Penny Carter

Pin	Function		
1.	Frame Ground	5.	Clear to send
2.	Transmit	6.	Data set ready
3.	Receive	7.	Signal ground
4.	Request to send	8.	Rec'd Line detect
		20.	Data terminal ready

Figure 1 WIRING DIAGRAM FOR SOLDER SIDE OF 25-PIN RS 232 MALE CONNECTOR GOING TO NOVAR

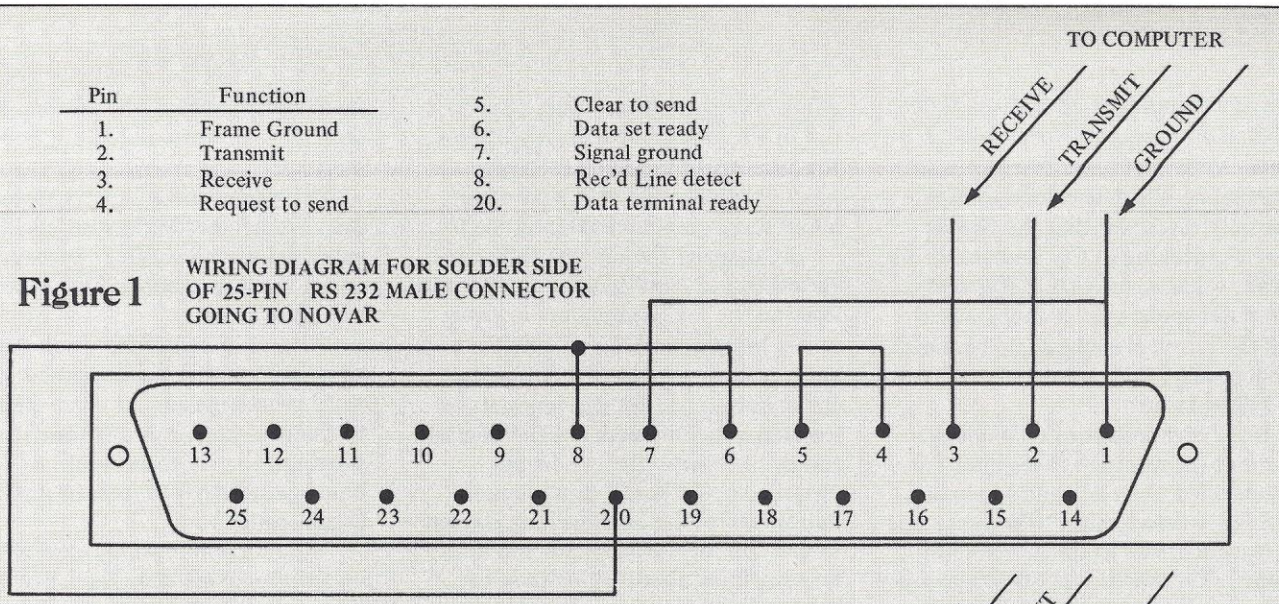
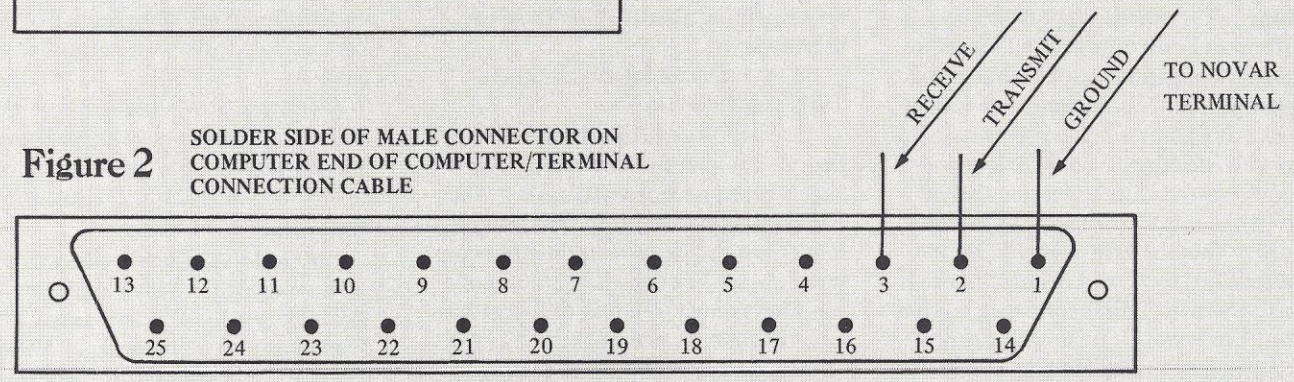
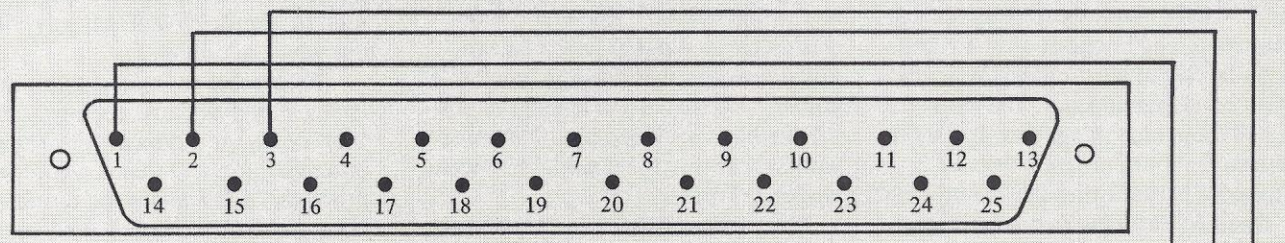


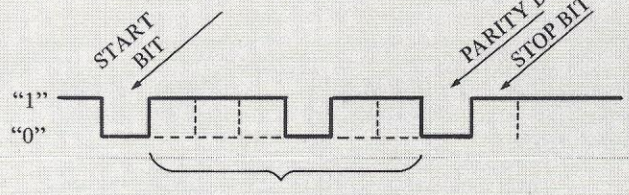
Figure 2 SOLDER SIDE OF MALE CONNECTOR ON COMPUTER END OF COMPUTER/TERMINAL CONNECTION CABLE

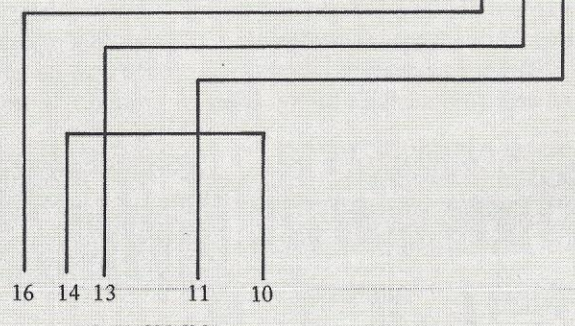




SOLDER SIDE OF FEMALE CONNECTOR MOUNTED ON BACK OF COMPUTER

Figure 3 NOVAR SERIAL PROTOCOL 134.5 BAUD





Refer to Software Listing

```
FF90   00 3E 00 7C 00 00 00 00 34 2F 00 6E 00 6D 1C 1F
FFA0   00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
FFB0   00 A0 89 B0 84 88 A8 09 B4 A4 B8 93 3B 37 11 07
FFC0   24 20 10 30 04 08 18 28 38 34 AB 2B B4 13 A4 87
```

The above is a numeric dump of the 'NONALPH' table, as referred to in the program. The index for this table is 'BASEAD', and the table may be relocated by changing the value of 'BASEAD.'

```
FFD0   90 39 36 3A 2A 0A 33 23 26 19 03 1A 06 21 12 05
FFE0   0B 1B 29 25 02 32 31 35 22 27 14 00 00 00 00 00
```

The above is a numeric dump of the 'ALTAB' table. It may be relocated by changing the value of 'ALTAB' in the driver program, just as with the 'BASEAD' table.

cause the technician was truly a nice fellow. He basically spoke English when he wasn't speaking BASIC. He'd been nice enough to deliver Turkey's system and set it up on his way home from work one night, since Turkey didn't have a car to pick it up at the store himself and had squandered his cab budget on false alarms. If they were all like the technician, Turkey was thinking while the message units ticked over, personal computing could get to be the barrel of monkeys it was cracked up to be.

"Oh yes, hello. The technician says he's not sure if it can be done, and you'd like me to call back in three weeks when you're not so busy . . . Yes, indeed! Thank you, Mr. Computer Store Manager. Thank you Ever so Much!"

Well, back to square one. Turkey was beginning to wonder why Babbage's father had bothered. In fact, Turkey'd plunged to the depths of the technological underworld and they'd torn his mortal frame asunder.

Turkey fights back

And so it came to pass that Turkey was forced into an activity that some folks would say suited him little better than a rented tuxedo – that is, A Little Hard Thinking.

It all started as a few turkey-scratch notes on a coffee-stained Scot towel.

GIVEN 1: Novar 5-41 business data communication terminal designed for serial communication with either another terminal or a computer.

GIVEN 2: Home microcomputer built around the Technical Design Labs ZPU (central processing card based on Zilog Z-80) and System Monitor Board (SMB).

PROBLEM: How does one interface said terminal and computer so that the terminal can be used as a hard copy printer?

As Turkey thought about it, there were really two different problems here. First, he wasn't quite sure how to hook up the wires between computer and terminal. Indeed, as he looked at the zillion-pin connector sticking out the back of the terminal, he had visions of sparks flying around inside his beloved machines and teleporting him from the roasting pan into the proverbial fire. Second, even if he did hook up the wires correctly, he wasn't sure what kinds of electrical sweet-nothings to tell his computer to whisper down the wire in order to make the terminal sing.

"But," said Turkey, waving a feather in the air, "if I solve the first problem, I might be able to send all kinds of numbers and characters and patterns of bits and things down the wire until I provoke the terminal into chattering back something – anything – and thus I may be able to figure out its accustomed *linqua franca.*

Warming to the task, Turkey set about figuring out the electircal hookup. He had one small clue – RS 232.

"RS 232!" the man at the terminal company had shouted as Turkey'd backed out the door with the terminal in his wings. If he could figure out the meaning of this cryptic phrase, Turkey felt, the hookup problem would fall like the walls of Jericho.

So back to the books went Turkey. Sure enough, his labors paid off. RS

232, he discovered, is an electrical standard for transmission of digital data defined by the Electronic Industries Association. To be more precise, it standardizes the voltage and impedance levels on lines used for data communication. Well, Turkey understood the voltage part okay, but the word "impedance" threw him. After mulling it over a bit, however, he decided to forget about that part of the discussion since he wasn't trying to design circuits anyway, he was only trying to hook up two circuits that were presumably already designed for proper electrical compatibility.

He did find out, however, that there are two versions of RS 232 – B and C. The major difference between the two is the range of voltage swing between the "0" level and the "1" level. With RS 232C the permissible voltage for a logic "1" ranges from -5V to -15V. A logic "0" ranges from +5V to +15V. Voltages between -5V and +5V are in the so-called transition region, which means that the machine currently on the line should not tarry at these never-never-land voltage levels too long or it might confuse the machine on the listening end. RS 232B is quite similar, except the logic "1" is allowed to range from -5V to -25V and the logic "0" from +5V to +25V. It is an older standard.

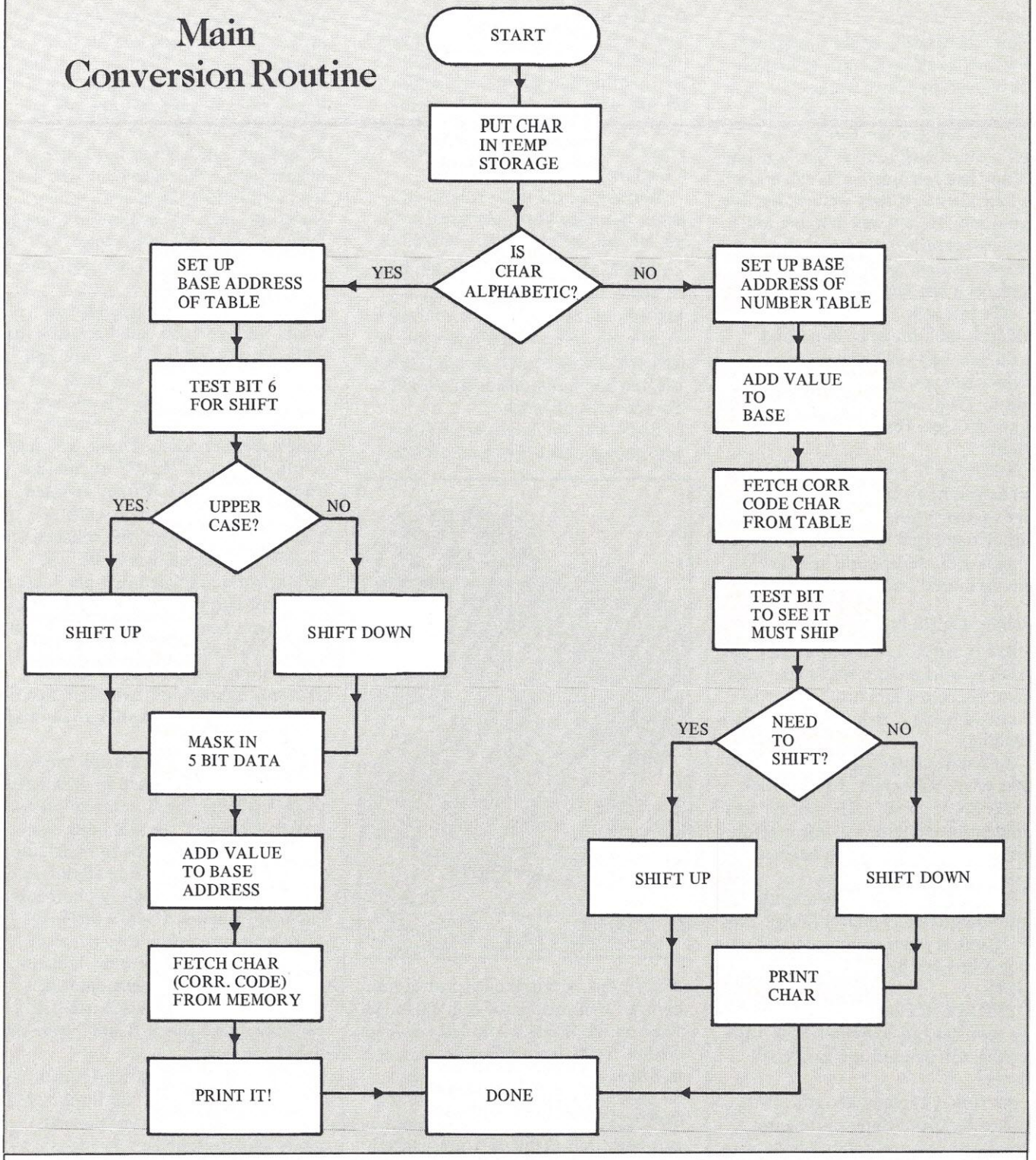
With this information under his wing, Turkey felt he could measure the voltage swings on the data output pin of the Novar terminal and figure out which version of RS 232 he encountered. But now he had to figure out which pin to measure. Turkey's source of information of RS 232 discussed a 25-pin D connector. Turkey counted the pins on the Novar and, *voila!* – twenty-five! Moreover, the connector was vaguely shaped like a "D". The source further revealed that pin 7 was usually the signal ground, pin 2 the pin dedicated to transmission of data from the terminal and pin 3 the pin for conveying information into the terminal. The only ominous note was that manufacturers didn't always stick to the standard pin designations.

Before slapping a voltmeter on the terminal, Turkey decided to do a little cross-checking. "Never jump to premature conclusions!" he said pompously. When he'd picked up the terminal, the man at the terminal store had thrown in about 10 pages of faintly photocopied logic diagrams. It was a jungle of small-scale integration that was truly quite perplexing, but Turkey looked these up anyway and, sure enough, when he found the input section, it confirmed that pins 2, 3 and 7 were the ones he sought.

By now Turkey felt he was really cooking with methane. He turned on the terminal, whipped out the voltmeter, and measured a very nice -12V across pins 2 and 7. It seemed to Turkey that he had a classical case of RS 232C on his hands.

Now, what about his computer? Turkey looked up the circuit diagram of his System Monitor Board in the manual that TDL had kindly supplied. Since the maximum and minimum supply voltages on the board were +12V and -12V respectively, the RS 232 signal supplied by his computer couldn't possibly swing beyond these extremes, according to Turkey's line of reasoning. Electrically speaking, it looked like he

Main Conversion Routine



Initialization Routine

1. Change vector at F815 to C3 00 FF.
2. Turn on the Novar printer. XMIT, TYPE and READY lights should all be on. Depress TYPE switch. The TYPE light should go out.
3. Using the monitor, enter the following commands:
   a) AL = U — This assigns line printer to user routine.
   b) QO70,15 — This initializes ACIA on SMB.
   c) QO71,F4 — This initializes the Novar.
   d) QO71,F4 — Novar should print out a "9", indicating that initialization is complete.

had the makings of a marriage made in heaven.

Now Turkey looks in the front of his SMB Manual. Here he found very explicit instructions for hooking up a teletype via the RS 232 port. The instructions told him to connect a jumper between pin 4, Request To Send, and pin 5, Clear To Send, on the 25-pin RS 232 connector going to the teletype. It further told him that he should connect a jumper between pin 6, Data Set Ready, pin 8, Receive Line Signal Detect, and pin 20, Data Terminal Ready, and yet another jumper between pin 1, Frame Ground, and pin 7, Signal Ground.

Suddenly, Turkey felt another wave of apprehension. Suppose Novar didn't follow the same pin conventions as the Brand X terminal companies? Turkey went back to the Novar logic diagrams and, with a sigh of relief, discovered that his fears were groundless – pin 4 was indeed Request To Send and the other pins named seemed to be as they should be.

Now Turkey really felt he had it knocked! Ah, false confidence! First off, he sent to some obscure mail order house for an RS 232 25-pin connector set. When the parts arrived he warmed up his trusty old 40-watt soldering iron and tediously soldered the male connector to one end of an appropriate cable and the female connector to the opposite end. Heart racing, he plugged the male end of the cable into the receptacle on the back of the computer and started to plug the female end into his terminal only to discover that he was trying to be the matchmaker for an unnatural relationship! "What's this?" he cried as he realized his foolish oversight. Face red, he apologized to Mdm. Novar and filled out the order form for another male connector.

Ten days later, Turkey tried it again with the proper connectors. When the last solder joint had cooled to a righteous dull haze, he plugged in the cable. Truly excited, he booted up the computer, loaded BASIC, turned on the Novar, and keyed in a short program incorporating lavish LPRINT statements. With remarkable poise, considering how long he had awaited this moment, Turkey punched out RUN on the keyboard. Looking fondly down at the silver golfball in the carriage of the Novar, he hit CR and waited . . . and waited . . . and waited.

Moments later, seriously considering some diabolic scheme of technocide followed by self-immolation, he jerked the plug on his machines, snapped off the lights in the computer room and stomped off to bed. Nothing had happened. Absolutely nothing. Like Mona Lisa, Mdm. Novar had sat, a faintly mocking gleam on her immobile golfball.

Fortunately Turkey isn't the type to hold a grudge for long. The next morning found Turkey hard at work over his much be-cuneiformed Scot towel.

SYMPTOM: Novar just sits there.

POSSIBLE CAUSES: 1) wrong hookup; 2) computer not outputting through proper port; 3) Novar not working; 4) ASCII code incompatible with Novar code.

Somehow Turkey wasn't quite ready to accept the first hypothesis. He reviewed his sources of information and his subsequent reasoning several times over, and each time came up with the same hookup.

Looking fondly down at the silver golfball in the carriage of the Novar, Turkey hit the CR and waited... and waited... and waited...

Hypothesis two he eliminated by checking the output pin from his computer with a voltmeter. The needle of the voltmeter wiggled and waggled just as he'd hoped it would when he ran his little BASIC test program.

Hypothesis three he wasn't quite ready to accept since a nice technician that he'd hired to replace the worn platen on the machine had checked out the Novar's electronics by hooking it into a test program on a time sharing system. The Novar passed with flying colors. While the technician knew nothing about code conversion, he did throw out a few valuable clues.

"Look," he said, "I'm pretty sure it's a six-bit code plus one bit for parity. The way they get the shift characters is by sending a separate character for 'shift up' or 'shift down' such as the case may be. Now electrically, that line just sits there at logic '1' until the computer puts out a character. The first thing that happens is that the line drops to logic '0' for one bit, which is the start bit. This bit tells the terminal that a character is coming down the pike. Then the six-bit character code comes along. The seventh, or parity, bit is either a '1' or a '0' depending upon the number of ones in the character bit. I can't remember if you get a parity '1' if there are an even or an odd number of bits in the character."

"What's a parity and what happens if you get the wrong one?" Turkey asked.

"The parity bit is used for error detection. It tells the terminal that the number of logic ones in a character sent by the computer is the same as the number of logic ones received by the terminal. Nothing much happens, really, if you get the wrong parity," the technician had said. "The transmission error light on the panel next to the keyboard goes on, but otherwise the terminal keeps working."

"That's all there is to it?" Turkey had asked.

"After the parity you need one stop bit at logic '1'. Also, the rate at which the bits get sent down the line is quite important. It has to be 134.5 bits-per-second. Otherwise the terminal won't work properly."

"That's it!" Turkey shouted as he reviewed this conversation in his mind. "I don't know what bit rate my computer is putting out!"

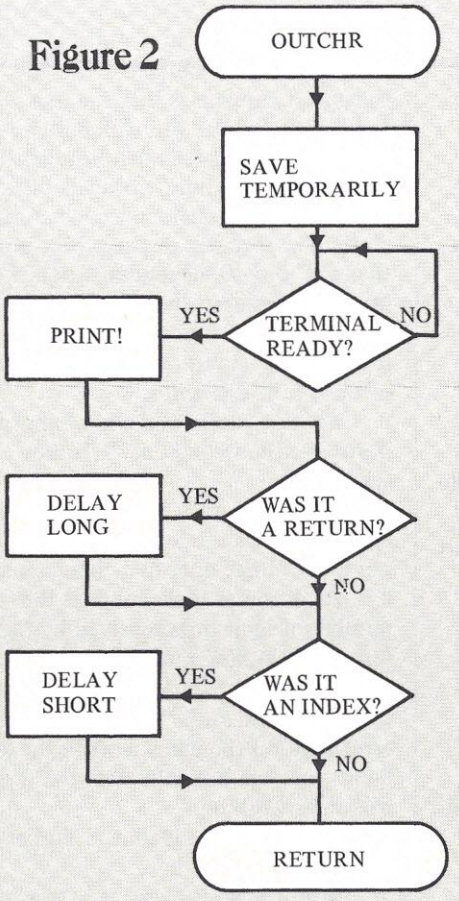
So back to the SMB Manual went Turkey, only to meet up with still another blow. According to the manual, the SMB could generate 9600, 4800, 1200, 600, 300 or 110 baud, but it made no mention of 134.5.

At about this time Turkey was noted by friends to be perpetually morose. He took to walking dark streets alone and frequenting all-night diners. More than once he was seen wearing mismatched socks and the food on his plate often ended up in the disposal.

In truth, Turkey was mulling over complicated schemes of external UARTs and clock generators. At one point he even fantasized a gigantic computer between his TDL system and the Novar that was expressly dedicated to translating ASCII characters into whatever weird code the Novar wanted and putting them out at the proper baud

Conversion Subroutines

Figure 2



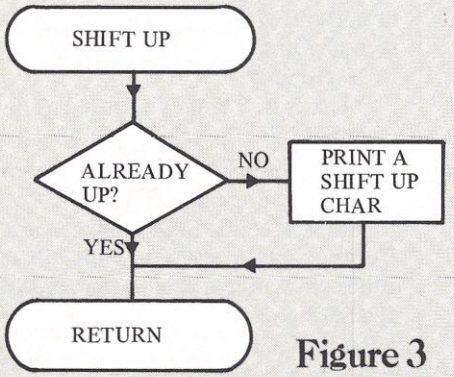


Figure 3

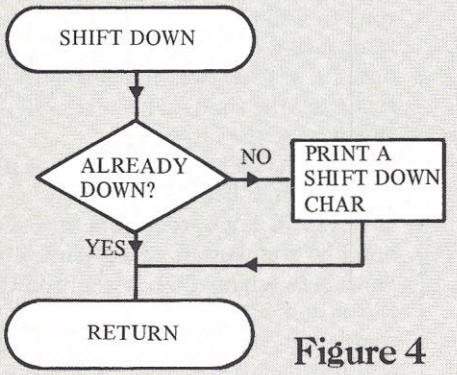


Figure 4

Program Listing

```
                        ;NOVAR TERMINAL DRIVER BY PETER HENRY, 1978
0000' C5                ENTER: PUSH B
0001' D5                PUSH D
0002' E5                PUSH H ;SAVE ALL THE REGISTERS THAT WE WILL USE
0003' 11 0D0D           LXI D,0D0DOH ;SET UP FOR A DELAY
0006' CD 0083'          CALL COUNT ;AND GO DELAY BEFORE PRINTING
0009' 79                MOV A,C ;PUT IT (CHAR IN THE ACC)
000A' E640              ANI 040H ; MASK FOR TEST TO SEE IF ALPHABETIC
000C' 281D              JRZ NONALF ;GO TO NONALF IF NOT ALPHABETIC
000E' 21 FFD0           LXI H,ALTAB ;LOAD ALPH TABLE ADDRESS
0011' 79                MOV A,C ;FETCH THE ORIGINAL CHARACTER
0012' E620              ANI 020H ;GET THE SHIFT BIT ONLY
0014' 2005              JRNZ LCASE ;GO TO LCASE IF LOWER CASE
0016' CD 0062'          CALL SHFTUP ;SHIFT GOLF BALL UP
0019' 1803              JMPR CONT ;AND CONTINUE WITH OUTPUT
001B' CD 0071'          LCASE: CALL SHFTDN ;SHIFT GOLF BALL DOWN
001E' 79                CONT: MOV A,C ;FETCH ORIGINAL CHARACTER
001F' E61F              ANI 01FH ;MASK IN THE DATA ONLY
0021' 1600              MVI D,0H ;SET UP FOR INDEX OF TABLE
0023' 5F                MOV E,A ;.....MORE SET UP
0024' 19                DAD D ;PERFORM THE INDEX UP THE TABLE
0025' 7E                MOV A,M ;FETCH CORR. CODE CHAR.
0026' CD 004D'          CALL OUTCHR ; AND PRINT IT!!
0029' 181E              JMPR DONE ;AND GO FINISH UP!
002B' 79                NONALF: MOV A,C ;FETCH ORIGINAL CHARACTER
002C' 21 FF90           LXI H,BASEAD ;LOAD NON ALPH. TABLE ADDR IN HL
002F' E63F              ANI 03FH ;MASK IN THE RAW DATA ONLY
0031' 1600              MVI D,0H ;SET UP FOR THE INDEX
0033' 5F                MOV E,A ;MOVE INDEX VALUE TO E
0034' 19                DAD D ;PERFORM THE INDEX
0035' 7E                MOV A,M ;FETCH THE CORR. CODE. CHAR.
0036' C600              ADI 0 ;THIS IS A DUMMY ADD TO SET CONDITIONS
0038' FA 0040'          JM SHIFTR ;MSB INDICATES A SHIFT UP NEED
003B' CD 0071'          CALL SHFTDN ;NO UPSHIFT, SO DOWNSHIFT!
003E' 1803              JMPR CONTNU ;AND CONTINUE!
0040' CD 0062'          SHIFTR: CALL SHFTUP ;SHIFT GOLF BALL UP!
0043' 7E                CONTNU: MOV A,M ;RE-FETCH THE DATA
0044' E67F              ANI 07FH ;MASK IN THE REAL DATA ONLY!
0046' CD 004D'          CALL OUTCHR ;PRINT THE CHARACTER,...
0049' E1                DONE: POP H ;AND WERE ALL DONE!!
004A' D1                POP D ;RESTORE REGISTERS IN REVERSE ORDER
004B' C1                POP B ;..........!
004C' C9                RET ;AND RETURN! SUBRS FOLLOW....
004D' 47                OUTCHR: MOV B,A ;SAVE TEMPORARILY
004E' DB70              TEST: IN 70H ;GET THE PORT STATUS ***
0050' CB4F              BIT 1,A ;TEST FOR A READY
0052' 28FA              JRZ TEST ;LOOP IF TERMINAL NOT READY
0054' 78                MOV A,B ;AT LAST!! RESTORE CHAR!
0055' D371              OUT 71H ;AND PRINT IT!!!
0057' FE6D              CPI RETURN ;WS IT A RETURN
0059' CC 0080'          CZ DELAY1 ;IF YES, THEN DELAY LONG
005C' FE1D              CPI INDEX ;WASIT A LINE FEED?
005E' CC 008A'          CZ DELAY2 ;IF YES,THEN DELAY SHORT...
0061' C9                RET ;WERE ALL DONE HERE!!
0062' 3A FFFE           SHFTUP: LDA SHSTAT ;GET THE SHIFT STATUS
0065' C600              ADI 0H ;DUMMY ADD HERE!!
0067' F8                RM ;RETURN IF WE ARE ALREADY UP!
0068' 3EFF              MVI A,0FFH ;ELSE...
006A' 32 FFFE           STA SHSTAT ;SET THE STATUS TO UP..
006D' 3E1C              MVI A,SHIFTU ;AND FLIP THE GOLF BALL....
006F' 18DC              JMPR OUTCHR ;BY PRINTING A SHIFT UP! (JMP+RET)
0071' 3A FFFE           SHFTDN: LDA SHSTAT ;SAME AS SHFTUP ROUTINE, EXCEPT...
0074' C600              ADI 0H ;WE'RE GOING TO SHIFT DOWN!!
0076' C8                RZ
0077' 3E00              MVI A,0H
0079' 32 FFFE           STA SHSTAT
007C' 3E1F              MVI A,SHIFTD
007E' 18CD              JMPR OUTCHR
0080' 11 0000           DELAY1: LXI D,0H ;THESE ARE JUST DELAY LOOPS,...
0083' 14                COUNT: INR D ;COUNTING UP DE TO 0.........
0084' 20FD              JRNZ COUNT
0086' 1C                INR E
0087' 20FA              JRNZ COUNT
0089' C9                RET
008A' 11 7070           DELAY2: LXI D,07070H ;SHORT DELAY CONSTANT
008D' 18F4              JMPR COUNT
FFD0                    ALTAB=0FFD0H
FF90                    BASEAD=0FF90H
006D                    RETURN=06DH
001D                    INDEX=01DH
FFFE                    SHSTAT=0FFFEH
001C                    SHIFTU=01CH
001F                    SHIFTD=01FH
```

```
                +++++ SYMBOL TABLE +++++

ALTAB  FFD0      BASEAD FF90      CONT   001E'     CONTNU 0043'
COUNT  0083'     DELAY1 0080'     DELAY2 008A'     DONE   0049'
ENTER  0000'     INDEX  001D      LCASE  001B'     NONALF 002B'
OUTCHR 004D'     RETURN 006D      SHFTDN 0071'     SHFTUP 0062'
SHIFTD 001F      SHIFTR 0040'     SHIFTU 001C      SHSTAT FFFE
TEST   004E'
```

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rate. More typically during this period, Turkey was thinking about giving up the material life altogether for more spiritual pursuits.

Turkey meets the Wizard

One day Turkey found himself browsing listlessly through a strange computer store. A man asked if he needed help and, normally one to keep his problems to himself, Turkey unaccountably found his troubles spilling like a torrent out his beak. The man behind the counter kept nodding his head sympathetically and clucking his tongue at each new episode.

"You got yourself quite a problem there, fellow," said the man when Turkey finished. "I don't think we can help you, but we've got a kid who hangs out here who's a wizard at these problems."

It was all Turkey could do to keep from jumping over the counter and kissing the man.

"His name! His name!" Turkey cried.

"We just call him the Wizard of Newton," the man said as he wrote a name and number on the pad. "He just might be able to give you a hand."

Turkey lost no time looking up the Wizard. At first he was afraid that the computer store man was pulling his leg when he met the fabled magician face-to-face, because the Wizard of Newton was really quite young for your typical card-carrying sorcerer. But the gleam of self-assurance in the Wizard's eye as Turkey explained his problem banished all doubt like bad dreams in the night.

"What kind of chip does your computer use to generate clock signals?" the Wizard asked when Turkey finished.

Now Turkey had never really given this a thought. Indeed, he had to look it up in his SMB Manual.

"A Motorola MC 14411—" said Turkey after studying the schematic.

"I know that chip," said the Wizard. "I'm quite sure it will generate a 134.5 baud clock signal."

After some searching, Turkey found technical information on the MC 14411 in his friend Don Lancaster's *TV Typewriter Cookbook*. Sure enough, pin 14 is supposed to put out a lovely 134.5 clock signal. Now Turkey referred back to his System Monitor Board and discovered a solder connection available at pin 14, but no silkscreen designation of its purpose whatsoever.

"If you connect the TTY Baud Rate jumper on your System Monitor Board to pin 14, then try your test program," said the Wizard, "it just might work."

No sooner said than done and – Behold! The terminal barked to life with a short line of nonsense characters.

Oh, Turkey was happy! He was ecstatic! If only all such lines of nonsense of so little accord could put such joy into our hearts!

"Now all we need," said the Wizard, "is this mysterious Correspondence code, and I can conjure up a conversion program for you faster than you can say Central Processing Unit."

That night Turkey couldn't sleep. "How in the world can I get that code?" he muttered. "On the one hand I have a mechanism that makes a silly golfball dance around like John Travolta. On the other hand I have a stream of logic ones and zeroes traipsing down

the wire. In the middle I have a shoebox full of logic circuits that read the input line and then tell the golfball what steps to do. Wait a minute! Turkey's mind was now racing. If I knew what parallel signals the solenoids on the printer mechanism need to print out various characters, I could work back through the logic to find out what kind of serial characters make the logic produce those codes. And, as a matter of fact, I already have those parallel codes in ol' Don Lancaster's book!"

Turkey jumped out of bed and started working feverishly. Using the photocopied diagrams that he'd received with his machine, he traced logic lines down one page and up another. He tore sheet after sheet off his roll of Scot towels, writing copiously on one, then another. Three a.m., four, five a.m., six – Turkey worked through the night. At last, as the sun peeked through the potted plants in his window, Turkey stood back in admiration of a neatly printed table. "There, if I'm not mistaken," he wept, "is the elusive serial code that'll make Mdm. Novar sing!"

"I think you've got it!" the Wizard said when later in the day they conferred. The Wizard sat down at Turkey's keyboard and ran a few tests, feeding the code out a character at a time using appropriate routines residing in Turkey's monitor. The Novar worked just fine, but still there was a thoughtful look on the Wizard's face.

"I'm not quite sure why this is working," he said as he examined the text hammered out by the Novar. "You have a Motorola MC 6850 Asynchronous Communication Interface Adapter on your System Monitor board that can be programmed to put out all kinds of character configurations with different numbers of start and stop bits, odd, even or no parity bits, and all that. But it's designed to handle seven or eight bit characters. The Novar's looking for six-bit characters. I've put a 15H into the instruction register of the 6859 which tells it to put out one start bit, an eight-bit character with no parity and one stop bit. Apparently the Novar's reading the first six bits of the characters we're putting through, reading the seventh bit as parity and ignoring the rest. So I can include the parity bit right into the eight-bit character stored in the lookup table of the conversion program, tell the ACIA to put out an eight-bit character and not bother about parity, and so far as the Novar is concerned it shouldn't matter a hill of beans. You might say we'll be operating on borrowed bits."

"You can't knock success."

"No, I guess not," said the Wizard. "As long as it works. . ."

And so dear reader, here ends the tale of Techno Turkey's journey through the underworld. The following Sunday the Wizard delivered a machine language program that fit just fine in spare RAM starting at FF00 on Turkey's System Monitor Board. By changing a single vector located at F815 from C3 C1 F9 to C3 00 FF and entering a few monitor commands to initialize both the 6850 interface chip and the Novar, Turkey was able to print out beautiful Selectric copy. In fact, Turkey loaned me his system to edit and type this very saga.

MORAL: Even a turkey can beat the high priests of technology at their own game – given courage, determination, and a little help from a wizard. □

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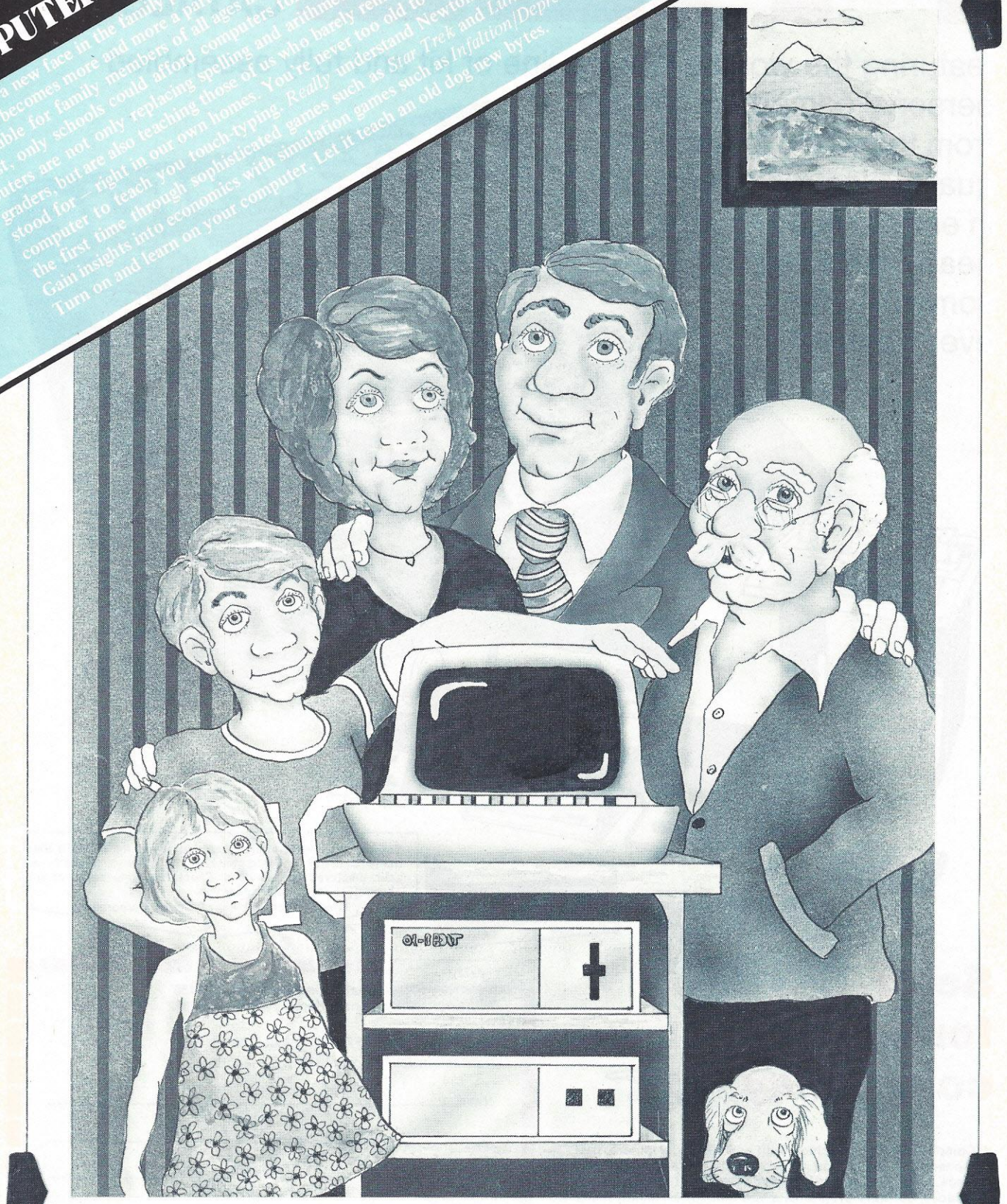

Illustration by Stephen C. Fischer

Classroom Computer

BY JOHN B. PALMER

Mary, of Mother Goose fame, had a little lamb which followed her to school; John Palmer had a microcomputer. Palmer made arrangements to bring his micro into some classrooms for a few hours each week. Results? Teachers and students learned about small computers. But Palmer learned something too – that an instructor's imagination and his relationship with students is what education is all about.

Effective teaching aids make good teachers better. And microcomputers make effective teaching aids.

Yes, micros are limited, compared to their larger counterparts, but instructors can use them effectively as classroom aids. All the exercises in this article can be performed on a small BASIC-speaking microcomputer with limited memory.

When I took my computer into a school for a few hours each week, I tried different things, even teaching BASIC programming as part of a course. But simulation games proved the most useful; students enjoyed playing these, and teachers felt they held student interest and reinforced previously covered concepts. Students benefitted most when teamed in simulations of real-world problems. Few inputs, dynamic outputs and a fast pace kept their minds trained on what they were doing.

But not all was fun and games. We encountered three problems: the math class, shy students and timesharing boredom.

Math class seemed the logical starting place for the computer – in fact, a math teacher who thinks students should be able to use hand calculators to solve math problems suggested I bring the micro into his classroom – but nevertheless, math class proved a hurdle.

My micro uses BASIC language, best for problems when they're expressed as a series of algebraic statements. So we started on some word problems. I showed one student how to use the computer as a calculator by means of the PRINT statement and the four arithmetic operators. She quickly solved the problem using the computer while other students struggled with their hand calculators.

But computers are not infallible. The computer gave less accurate answers than hand calculators. Most low-cost microcomputer systems use only six digits for arithmetic operations; many hand-held calculators have twelve. To show students the computer was more useful than a calculator, if not as accurate, I needed a program written to solve problems requiring more than a few steps.

I modified one problem so that finding the answer would require log tables. The students, who were adept at using their calculators to stumble upon a math problem's answer, tried to solve this one by trial-and-error. Soon they were eagerly paying attention as I showed them how to program computers to hunt for an approximate answer to a mathematical formula. The computer gave a satisfactory answer within two minutes, while calculators took up to an hour.

During the following weeks other groups of students used the micro for simple puzzles, games and graphics that were fun for everyone. Well, almost everyone. The computer intimidated some of the shyer students – until I found a way to overcome their timidity.

When the class bell rang I told the students we would try a new game, "Petals Around the Rose". The computer displayed a simple pattern. If a student thought he knew the secret (the algorithm generating the answers), he could say the number but not explain how he calculated it. Anyone who could guess three times in a row was acknowledged as the one who understood the puzzle. The game continued until everyone in the class had learned the secret. (For more information on "Petals Around the Rose", see *PC*, September/October 1977; for a program to play the game, see *PC*, July 1978.)

Perhaps this game works with shy students because they don't have to explain how they got the answer. Usually the more outspoken students start with wild guesses only to fail on the second or third try. Not criticizing a student for a wrong answer, but instead going on to the next one, seems to help the shyer students. They'll volunteer guesses if they're sure they won't be embarassed. But if any student starts expounding his game theory, remind him that he cannot discuss it. Preventing outspoken students from dominating the classroom ensures that the game will continue to hold the attention of even the shyest students.

Time-sharing makes students' attention a real problem. In big time-sharing computer systems, everyone has his own keyboard and video display. In a low-cost system, time-sharing means each student has to wait for keyboard time. At first this was no big problem – the computer system was novelty enough so everyone gathered around the terminal to watch and wait for a turn at the keyboard.

But soon the excitement of the computer died. It was still fun, but only to the student at the keyboard. It was no longer fun to just watch. At the beginning of the school year students, thrilled by the paper that came off the teletype, saved it up to show their parents. Now they were getting restless.

Part of the problem was the equipment. Substituting a video display for a teletype helped some. But students more than eight feet from the screen, who couldn't see what the

How to Play the Game

The following notes could be passed to the students before beginning the simulation.

Inflation/Depression is well-suited for a large group divided into four teams. Or one to four individuals may play to dramatize how a society can cause itself economic distress through unrestrained cupidity.

Each team should appoint a chairman and a secretary. If using a video display, each secretary must copy the relevant data before it goes off the screen.

The computer shows the results as they would apply to one of the four members. Each team must decide whether to go on strike or not. Next the computer asks how much they wish to buy, which includes the purchase of luxuries in addition to basics.

Each new year the computer reports the cost-of-living index, the resale index and the current interest rate. Teams should record this information to aid in decision making.

Inflation will occur if the population has spent more money than it has in the bank. In other words, credit buying causes inflation and also makes the cost-of-living index greater than one. Also, if the total wages paid out are above the norm, inflation occurs.

If a team spends more money than it has in the bank, *credit* is given at the current interest rate. Half must be paid back next year. The interest rate may change.

The value of all material goods is multiplied by the current resale index. If necessary, the computer will cause some or all *property* to be sold to cover the current year's debts. Or the team may wish to sell property by entering a negative number when the computer asks "How much will you buy?" Selling property increases the bank account.

It's best to avoid going on *strike* unless the cost-of-living rises. A team may lose up to twelve months of work and might get a pay cut. Going on strike and buying on credit in the same year could bring on bankruptcy.

Depression occurs when the population saves money instead of spending it or when a large amount of property has been sold. A quick depression may follow an inflationary period, unless everyone uses good judgment.

The game is based on the proverb, "If possible, things will usually go from bad to absolutely unbelievable."

Additional Rules

After playing several times, students may want more rules to the game. They should be allowed to make their own rules and ethics. You could, of course, program the computer to put all sorts of stipulations on the inputs. But I think this reduces the game's educational value.

To keep the game simple, the computer allows players to buy or sell any amount, including more property than they have. Is this impossible? Not really. Ask the students if they can think of situations where someone might receive payment for undelivered merchandise. Is this cheating? When would it work to someone's advantage? When not? The game should make students think about things that can and do happen in the world in which we live.

Inflation/Depression is not intended to be a serious mathematical study of economics.

computer was outputting, got restless. Arranging several small chairs in a semi-circle around the video screen, elevated slightly above eye-level, cutting down room lighting and adjusting contrast control on the monitor to improve readability, solved this problem.

Because my system's keyboard is separate from the video monitor, a student could operate the computer without blocking the others' view. Perhaps some manufacturers will soon offer low-cost big screen monitors for educational use.

When the class was too large for everyone to gather around the computer, I tried another approach. While a few students were at the monitor, the rest listened and watched as I explained the meaning of computer output.

We did this several times with a simple game, "Lunar Lander". A day before the computer session, the physics teacher reviewed with the students the basic concepts of velocity, gravity, acceleration and free-fall. When the computer session started, I divided the class into teams of three. The computer displayed the altitude, velocity and quantity of fuel aboard a make-believe spaceship heading for the moon. I wrote this information on the board so the whole class could see and follow the game.

Usually the game is played with just one person, but we decided it should be played by three. After all, a real spacecraft would have a three-man crew. And this way everyone got to sit at the computer at least once during the allotted class time. Choose one of the more outgoing students as captain and two quieter students as his assistants.

More often than not there will be "failures". By carefully studying the computer data, the students can see how best to land a simulated rocket on the moon. Explaining to the rest of the class why the simulation was or was not successful helps the remaining students to pay attention.

Upper grade students, already having studied economics and current events, understand how inflation or depression can come about because of society's spending and saving patterns. The inflation/depression simulation game included with this article dramatizes these concepts.

See Sample Runs 1 and 2. When the computer asks for the number of teams and number of years, enter "1" for each question. Normally, however, we played up to four teams and seven years. Few input options keep things simple and moving quickly.

The Program Listing summarizes the game rules in lines 1100 through 1210. A small computer system lacks the memory to contain both the game program and the complete instruction set, while the small video display prevents the whole class from reading the rules off the screen. Better to have a printed instruction set to hand out to every student. (See Box, "How to Play the Game".)

Although the program is quite simple it can illustrate many real-world events; use your imagination to supply the

details that the small computer can not handle because of lack of memory. For example, during a depression the computer displays a negative interest rate. Why? Because the government of this microcomputer world is trying to induce the population to buy on credit. But you can't buy on credit until you deplete your bank account. Negative interest means that not all the loan has to be paid back. Of course, the interest rate is always subject to change.

Occasions on which the govemment has offered to pay part of a loan to stimulate a sluggish economy are examples of negative interest. Usually some logical explanation for the computer output exists. The game demands that students pay attention and think about what is happening.

Whenever a team goes on strike, the computer uses the random number generator to simulate the complexity of this problem. So the computer cannot explain why the team lost so many months of work and got a pay cut or raise. Instead of telling students about the random number generator, let them make up their own theories. Let them use their minds. □

Sample Run Notes and Examples

To test the program for errors and to demonstrate how it works, enter the number "1" when the computer asks "How many teams?" and "How many years?" the output should be the same as in Sample Run 1.

In Sample Run 1 the player enters a value of zero in answer to the question "Want to strike?" Next the computer asks "How much will you buy?" The player entered the value of 1700. The computer then reported that the bank account is now at $300.

Because only one year is being played, the computer now gives the projected cost-of-living index, resale index and interest for the next year, then terminates the game by printing the results after one year. Only one player is in the game so there is only one final total.

Notice the value of 2640. How did the computer get this value? It added 1700 to 900 and then multiplied by .9, giving 2340. The resale index effectively reduced the value of the goods. Then 2340 plus the 300 in the bank gives 2640.

In Sample Run 2 the single player now tries to spend more money than he has in the bank. A value of 2500 is entered in response to the question "How much will you buy?" This time the computer zeros the bank account and extends $500 of new credit at the rate of 5%. At the end of one year the cost-of-living has risen to 1.01 – a 1% increase.

Notice the final value of 2521.88. Let's see why this year he ended up with less even after spending more money. The value of the "Goodies" is found by adding 900 to 2500 then multiplying by .9, which gives a value of 3060. However, he has to pay back a loan of $500 at 5%. Therefore, 500 times 5% plus the principal equals 525.

Wait a minute! He was going to pay off half of this amount in one year and the rest later. So the interest will have to be recalculated at the new rate for the unpaid balance. Now half of 525 plus the new interest rate of that amount will give about 275. So the final value comes to 3060 - 263 - 275 = 2522. Some values are not rounded off by the computer.

One might conclude it is wise not to buy on credit. Not always. It depends on what the other players are doing. In Sample Run 3 we have two groups playing for two years. The "teachers" decide to buy on credit while the "miners" want to go on strike.

The ledger in the second year indicates that the "teachers" have to liquidate some of their "goodies" to pay the current year's debts. They then decide it would be unwise to either strike or buy again on credit.

The "miners" have been playing conservatively. Now they decide to strike and sell all their property. They receive a raise almost double the cost-of-living rate. However, it is the last year of play so the ledger for the next year is not shown.

In the end the "miners" did better than the "teachers". If the game continued, the "teachers" might catch up. On some computer systems you can extend a game by entering the following: Z = Z + 5: GOTO 1300. This line will cause the computer to keep on playing for another five years.

```
    EXAMPLE ONE


HOW MANY TEAMS (1-4) ? 1
HOW MANY YEARS (1-7) ? 1


 1978  COST-OF-LIVING: 1
RESALE: .9  INTEREST: 5 %

TEACHERS  HAVE $ 900 GOODIES
 12 MO. AT $ 500 =     $ 6000
PREVIOUS BANK ACCOUNT $ 0
LESS LIVING EXPENSES  $-4000
LESS CREDIT PAYMENT   $ 0
LEAVING $ 0 DUE
BANK ACCOUNT AT       $ 2000
WANT TO STRIKE 1=YES,0=NO ? 0
HOW MUCH WILL YOU BUY ? 1700
BANK ACCOUNT AT       $ 300

 1979  COST-OF-LIVING: 1
RESALE: .9  INTEREST: 4.84 %

AFTER 1 YEARS OF CUPIDITY

GROUP:          TOTAL:

TEACHERS         2640


     EXAMPLE TWO


HOW MANY TEAMS (1-4) ? 1
HOW MANY YEARS (1-7) ? 1


 1978  COST-OF-LIVING: 1
RESALE: .9  INTEREST: 5 %

TEACHERS  HAVE $ 900 GOODIES
 12 MO. AT $ 500 =     $ 6000
PREVIOUS BANK ACCOUNT $ 0
LESS LIVING EXPENSES  $-4000
LESS CREDIT PAYMENT   $ 0
LEAVING $ 0 DUE
BANK ACCOUNT AT       $ 2000
WANT TO STRIKE 1=YES,0=NO ? 0
HOW MUCH WILL YOU BUY ? 2500
<<NEW CREDIT>> $ 500
INTEREST IS NOW 5 %


 1979  COST-OF-LIVING: 1.01
RESALE: .9  INTEREST: 5.27 %

AFTER 1 YEARS OF CUPIDITY

GROUP:          TOTAL:

TEACHERS         2521.88
```

```
    EXAMPLE THREE

HOW MANY TEAMS (1-4) ? 2
HOW MANY YEARS (1-7) ? 2


 1978  COST-OF-LIVING: 1
RESALE: .9  INTEREST: 5 %

TEACHERS  HAVE $ 900 GOODIES
 12 MO. AT $ 500 =     $ 6000
PREVIOUS BANK ACCOUNT $ 0
LESS LIVING EXPENSES  $-4000
LESS CREDIT PAYMENT   $ 0
LEAVING $ 0 DUE
BANK ACCOUNT AT       $ 2000
WANT TO STRIKE 1=YES,0=NO ? 0
HOW MUCH WILL YOU BUY ? 7500
<<NEW CREDIT>> $ 5500
INTEREST IS NOW 5 %

MINERS    HAVE $ 900 GOODIES
 12 MO. AT $ 500 =     $ 6000
PREVIOUS BANK ACCOUNT $ 0
LESS LIVING EXPENSES  $-4000
LESS CREDIT PAYMENT   $ 0
LEAVING $ 0 DUE
BANK ACCOUNT AT       $ 2000
WANT TO STRIKE 1=YES,0=NO ? 0
HOW MUCH WILL YOU BUY ? 2000
BANK ACCOUNT AT       $ 0

 1979  COST-OF-LIVING: 1.06
RESALE: .95  INTEREST: 8.01 %

TEACHERS  HAVE $ 7980 GOODIES
 12 MO. AT $ 500 =     $ 6000
PREVIOUS BANK ACCOUNT $ 0
LESS LIVING EXPENSES  $-4240
LESS CREDIT PAYMENT   $-2887.5
LEAVING $ 3118.5 DUE
*** OVERDRAWN ***     $-1127.5
TO AVOID JAIL YOU LIQUIDATE
GOODIES WORTH $ 1127.5
WANT TO STRIKE 1=YES,0=NO ? 0
HOW MUCH WILL YOU BUY ? 0

MINERS    HAVE $ 2755 GOODIES
 12 MO. AT $ 500 =     $ 6000
PREVIOUS BANK ACCOUNT $ 0
LESS LIVING EXPENSES  $-4240
LESS CREDIT PAYMENT   $ 0
LEAVING $ 0 DUE
BANK ACCOUNT AT       $ 1760
WANT TO STRIKE 1=YES,0=NO ? 1
HOW MUCH WILL YOU BUY ? -2755
BANK ACCOUNT AT       $ 4515
YOU LOSE 9 MONTHS OF WORK
AND YOU GOT A  17.01 % RAISE !


 1980  COST-OF-LIVING: 1.02
RESALE: .92  INTEREST: 6.23 %

AFTER 2 YEARS OF CUPIDITY

GROUP:          TOTAL:

TEACHERS        3092.25
MINERS          4515
```

Program Notes and Listing

This program has been tested on two different microcomputer systems. The program as written works in Level 1 of Radio Shack BASIC and all current versions of MITS BASIC. Two exceptions are the CLS statement in line 1000 and the RND(X) function in lines 1410, 1660, 1680 and 1700. The proper value for X is given in line 1290. It should be zero for Radio Shack and some other versions of BASIC. For MITS BASIC it should be one.

The program uses the TAB function extensively. If your computer lacks this feature, substitute commas or spaces. Don't omit semi-colons.

Depending on which version of BASIC you use, this program requires from 3300 to 3500 bytes of memory. In Radio Shack Level I BASIC it used 3529 bytes; it will just fit into the minimum TRS-80 system. If more memory is needed delete lines 1090 through 1210.

If not using Radio Shack Level 1 BASIC be sure to put this statement in line 1000: DIM A(20). The program does not use A(0) so it will work fine in Southwest Technical's BASIC for the 6800.

Most microcomputer BASICs allow several statements on a line by using a colon. Some other systems require use of a back-slash which is made by shifting the letter L. If your computer does not allow multiple statements, you must write the program with additional lines. All the lines are in tens, so there are enough numbers available to write in nine more lines after each of the existing lines.

Usually a statement following IF . . . THEN on the same line becomes an extension of the IF . . . THEN condition. Notice this in lines 1500, 1670, 1920 and 2020. If your computer does not allow this you will have to write additional IF . . . THEN statements after each of these lines.

Arrays

Some systems only allow the 26 letters of the alphabet as variable names. Using arrays allows more variables but requires Table 1 to make the program understandable to others.

TABLE I

Teachers	A(1)	A(5)	A(9)	A(13)	A(17)
Miners	A(2)	A(6)	A(10)	A(14)	A(18)
Grocers	A(3)	A(7)	A(11)	A(15)	A(19)
Drivers	A(4)	A(8)	A(12)	A(16)	A(20)

Array values are first set in lines 1220 through 1240. During the game array values are moved to single-letter variables in lines 1480-1490. Then in lines 1750-1760 they are put back into the array. Notice that W always indicates which player is now playing and locates the exact position in the array.

VARIABLE NAMES

B	Money in Bank
C	Credit
G	Goodies
H	How much will you buy?
I	Interest. See line 1420
K	Want to strike?
L	Cost-of-living index. See line 1880
M	Months of work
N	Loop counter
O	Oh Oh! depression
P	Percent interest
Q	Quota salary. See line 1410
R	Resale index
S	Salary
T	How many teams?
U	Unpaid debt
V	Variable Variable
W	Which team now playing?
X	RND(X); X = 0; see line 1290
Y	Current year
Z	Last year

Outline

Line 1000 contains the statement CLS for the TRS-80; for other computers change line 1000 to: 1000 DIM A (20):GO TO 1090.

Lines 1010, 1030, 1050 and 1070 contain the names of the four groups. You may replace these with names up to nine letters long. Don't forget the

Lines 1090 through 1210 contain brief instructions. If you need more memory in your computer then these lines may be omitted.

After setting the array and asking for number of teams and years the main program begins in line 1300. At the end of each year the program goes back to this line to calculate cost-of-living and other values.

Lines 1360 and 1370 warn of a bad depression. In case of high inflation a message is printed in lines 1390 and 1400. Line 1410 modifies the program, simulating an attempt by the powers that be to introduce new social programs, if things are really bad.

The program will loop around from line 1470 through 1760 for as many times as there are numbers of teams playing.

At the end of the given number of years the program goes to line 1770. Here the computer prints the final result for each team.

Line 1870 is, of course, where the play ends. Program lines below this point are subroutines. Line 1880 computes cost-of-living index. Line 1900 subtracts a credit payment from bank account. Line 1910 subtracts living expenses from bank account. Lines 1940 through 2010 are used whenever there is not enough in the bank to pay current debts. Lines 2020 through 2050 are used whenever a team buys a property. A negative number for the value of H will cause property to be sold and the money put into the bank.

```
1000 CLS:GOTO 1090
1010 PRINT"TEACHERS";
1020 RETURN
1030 PRINT"MINERS";
1040 RETURN
1050 PRINT"GROCERS";
1060 RETURN
1070 PRINT"DRIVERS";
1080 RETURN
1090 PRINT"     CUPIDITY !"
1100 PRINT"THE LEDGER REPRESENTS THE"
1110 PRINT"AVERAGE INDIVIDUAL OF EACH"
1120 PRINT"GROUP. THEY MAY GO ON STRIKE"
1130 PRINT"BUT CREDIT IS ALWAYS GOOD."
1140 PRINT"HOWEVER, THEY MUST PAY BACK"
1150 PRINT"HALF WITH INTEREST NEXT YEAR."
1160 PRINT"NO INTEREST ON BANK ACCOUNT."
1170 PRINT"THEY MAY OVERDRAW AND SELL"
1180 PRINT"PROPERTY AND GO BANKRUPT !"
1190 PRINT"GOODIES ARE THE CURRENT RESALE"
1200 PRINT"VALUE OF THEIR MATERIAL GOODS."
1210 PRINT"GAME END TOTALS CASH & GOODS."
1220 Q=500:FOR N=1 TO 4
1230 A(N)=0:A(N+4)=0:A(N+8)=2*Q
1240 A(N+12)=12:A(N+16)=Q:NEXT N
1250 PRINT"HOW MANY TEAMS (1-4) ";
1260 INPUT T:IF T>4 THEN GOTO 1250
1270 PRINT"HOW MANY YEARS (1-7) ";
1280 INPUT Y:IF Y>7 THEN GOTO 1270
1290 Z=1978+Y:Y=1977:U=0:X=0
1300 W=0:REMARK ***  START NEW YEAR HERE ***
1310 Y=Y+1:IF Y=Z+1 THEN GOTO 1770
1320 B=0:C=U:M=0:S=0:REM U IS UNPAID DEBT
1330 FOR N=1 TO 4:B=B+A(N):C=C+A(N+4)
1340 M=M+A(N+12):S=S+A(N+16):NEXT N
1350 PRINT:GOSUB 1880:O=0:IF L>.5 THEN GOTO 1380
1360 PRINT"DUE TO THE DEPRESSION THIS YEAR"
1370 PRINT"MANY WORKERS WILL BE LAID OFF.":O=1
1380 IF L<2 THEN GOTO 1420
1390 PRINT"DUE TO RISING INFLATION NEW"
1400 PRINT"SOCIAL PROGRAMS ARE INTRODUCED."
1410 Q=Q*(RND(X)+1):GOSUB 1880
1420 I=.55+L/2:P=100*(I-1):R=.9*L
1430 V=I:GOSUB 1890:I=V:V=L:GOSUB 1890:L=V
1440 V=P:GOSUB 1890:P=V:V=R:GOSUB 1890:R=V
1450 PRINT:PRINT Y;" COST-OF-LIVING:";L
1460 PRINT"RESALE:";R;" INTEREST:";P;"%"
1470 W=W+1:IF W>T THEN GOTO 1300
1480 B=A(W):C=A(W+4):G=A(W+8)
1490 M=A(W+12):S=A(W+16)
1500 IF Y=Z THEN G=G*R:GOSUB 1900:GOTO 1750
1510 PRINT:FOR N=0 TO 2000:NEXT N:REM TIMER
1520 IF W=1 THEN GOSUB 1010
1530 IF W=2 THEN GOSUB 1030
1540 IF W=3 THEN GOSUB 1050
1550 IF W=4 THEN GOSUB 1070
1560 G=G*R:PRINT TAB(10);"HAVE $";G;"GOODIES"
1570 PRINT M;"MO. AT $";S;"=";TAB(22);"$";S*M
1580 PRINT"PREVIOUS BANK ACCOUNT";TAB(22);"$";B
1590 PRINT"LESS LIVING EXPENSES";TAB(22);
1600 PRINT"$";-4000*L
1610 PRINT"LESS CREDIT PAYMENT";TAB(22);
1620 PRINT"$";-C/2:GOSUB 1900
1630 PRINT"LEAVING $";C;"DUE":GOSUB 1920
1640 PRINT"WANT TO STRIKE 1=YES,0=NO ";:INPUT K
1650 PRINT"HOW MUCH WILL YOU BUY ";:INPUT H
1660 GOSUB 2010:IF RND(X)<0/2 THEN GOTO 1680
1670 IF K=0 THEN M=12:GOTO 1750
1680 V=INT(12*RND(X)):M=12-V
1690 PRINT"YOU LOSE";V;"MONTHS OF WORK"
1700 V=P+INT(30*RND(X)-15)
1710 PRINT"AND YOU ";:IF V>0 THEN GOTO 1730
1720 PRINT"GET A ";V;"% PAY CUT":GOTO 1740
1730 PRINT"GOT A ";V;"% RAISE !"
1740 S=S*(1+V/100)
1750 A(W)=B:A(W+4)=C:A(W+8)=G
1760 A(W+12)=M:A(W+16)=S:GOTO 1470
1770 PRINT:REMARK ***  END OF GAME ***
1780 PRINT"AFTER";Z-1978;"YEARS OF CUPIDITY"
1790 PRINT:PRINT"GROUP:","TOTAL:":PRINT
1800 GOSUB 1010:PRINT" ",A(1)-A(5)+A(9)
1810 IF T=1 THEN GOTO 1870
1820 GOSUB 1030:PRINT" ",A(2)-A(6)+A(10)
1830 IF T=2 THEN GOTO 1870
1840 GOSUB 1050:PRINT" ",A(3)-A(7)+A(11)
1850 IF T=3 THEN GOTO 1870
1860 GOSUB 1070:PRINT" ",A(4)-A(8)+A(12)
1870 END
1880 L=(S*M-B+C)/(4*Q*M):RETURN
1890 V=INT(100*V+.5)/100:RETURN
1900 B=B-C/2:C=I*C/2:RETURN
1910 B=B+S*M-4000*L:RETURN
1920 GOSUB 1910:IF B<0 THEN B=-B:GOTO 1940
1930 GOTO 2050
1940 PRINT"*** OVERDRAWN ***";TAB(22);"$";-B
1950 PRINT"TO AVOID JAIL YOU LIQUIDATE"
1960 IF G>B THEN GOTO 2000
1970 C=C-G:G=0:PRINT"ALL OF YOUR GOODIES"
1980 B=0:PRINT"BANKRUPTCY -LAWYER FEE $";L*100
1990 U=U+C:C=L*100:RETURN
2000 PRINT"GOODIES WORTH $";B:G=G-B:B=0:RETURN
2010 IF H=0 THEN RETURN
2020 G=G+H:IF B>=H THEN B=B-H:GOTO 2050
2030 C=C+H-B:B=0:PRINT"<<NEW CREDIT>> $";C
2040 C=I*C:PRINT"INTEREST IS NOW";P;"%":RETURN
2050 PRINT"BANK ACCOUNT AT";TAB(22);"$";B:RETURN
```

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COMPUTER EDUCATION FOR ALL

Tickle My Keys
and I'll Teach You Anything

BY SONDRA AND STEVEN POLLINI

Consider the following imaginary, but possible, scenario:

In an elementary school, the children attending class that day in Room 5 welcome a new classmate. Despite his strange appearance, he exerts a mysterious pull on the children. His nickname is Aslan, his popularity immediate. Eager to play the games he knows, the students are also anxious to spend time alone with him, going over their lessons. His knowledge seems like an endless pool, but his way of conveying that knowledge has a gentleness about it.

Why does Aslan's uniqueness so profoundly affect the children? His background is one of extensive research and development. He was created from an idea and composed, not of flesh and blood, but of electronic components. Aslan is an Altair microcomputer system, but to the children he is a friend.

Around Aslan was built an extensive individual learning experience for each child in that room. Lesson presentations take the learning styles of most children into account. Aslan was programmed so that his techniques are gentle but effective, and at times even humorous. In other words, programming Aslan with a "personality" turned the dehumanizing computer which we feared into an invaluable teaching aide.

A computer, an invaluable teaching aide? Yes. Students in a classroom are all individuals, with more differences than even the most competent teacher can optimally plan for. Some students learn quickly, others more slowly, and all have different preferences for subject matter. A computer system adjusts to the needs of the pupils, rather than molding them to the system.

When the computer is up and running, teachers will be freed from the task of merely dispensing subject material to the children. Teachers can then devote their time to stimulating creativity, developing the early seeds of talent, challenging children to go beyond their limits, working with children on emotional difficulties or working in small groups to develop verbal and social abilities. Thus utilization of Computer Assisted Instruction (CAI) will enable teachers to meet the total needs of individual students, not just their intellectual needs.

Here is a program I developed for a group of children who might require token reinforcement as well as positive "verbal" reinforcement. (In a token reinforcement program students earn tokens, in the form of poker chips, points or stars, which they can later exchange for objects, or privileges. Your pay-

Table 1 Operant Conditioning

Computer presents preceding Stimulus (Signal)	Child Responds	Computer Presents following Stimulus (Reinforcement)
Computer presents the following configuration, and asks, "Which line has more Xs?" 1) X X X X 2) XXXX	"Number 1."	Computer responds, "No, they both have the same amount. Let's count each line together. 1)X X X X One Two Three Four 2) X X X X Four One Three Two "How about if we try another one?"
Computer presents the following configuration, and asks, "Which line has more stars?" 1) * * * * 2) * * * *	"They both have the same amount."	Computer responds, "Yes, they do have the same amount! Very Good!! I think you've got it Johnny!!!"

You can use the principles of operant conditioning when writing CAI programs. The computer presents a stimulus and then interprets the child's response. Feedback for both correct and incorrect answers should reinforce the desired behavior – that is, encourage the child to learn. For example, the computer could play a game with the child after the child answers say, 10 questions correctly.

Program Notes

Let's take a look at a CAI program set up for students in our hypothetical educably mentally retarded class. This student's name is Shawna, and the subject is science. For her behavior throughout the day she earns and loses tokens which can be exchanged for activity privileges (a form of secondary reinforcement). To make her time spent with Aslan optimally reinforcing, she can only earn tokens, not lose them. For completing the following program, Shawna could earn 3 bonus points. Within the program she can earn anywhere from 0-10 points.

Some of the information in this program was taken from *The How and Why Wonder Book of Astronomy* by Robert Scharff, Grosset and Dunlap, 51 Madison Ave., New York, NY 10010. Although this particular book is out of print, the publishers offer 14 other titles in the same series, including *The How and Why Wonder Book of Inventions, of Beginning Science, of Butterflies, of Birds, of Flight, of the Human Body* and *of North American Indians.* Books such as these serve as excellent source material when preparing CAI programs for young children.

Sample Run

```
                LESSON ONE OF THE WORLDS BEYOND OUR WORLD


OKAY, AND WHAT MIGHT BE THE NAME OF THE PERSON WHICH IS
TICKLING MY KEYS NOW?

? SHAWNA

OKAY SHAWNA, LET'S SEE IF WE CAN'T LEARN ABOUT
OUR SOLAR SYSTEM.

 THE PLANET OF WHICH WE ARE MOST FAMILIAR IS THE EARTH.  THIS
IS ONLY ONE OF THE NINE MAJOR PLANETS WHICH REVOLVE AROUND
OUR SUN.

WHAT IS THE NAME OF THE PLANET UPON WHICH WE LIVE?

? EARTH

* * * *   *    * * * *       * * *   *      *  * * * * !!
*        * *   *     *      *     *   *      *     *    !!
*       *   *  *     *      *     *   *      *     *    !!
* *    * * * * * * *        *     *   *      *     *    !!
*       *     * *    *      *     *   *      *     *
*       *     * *     *      * * *     * * *       *    !!

                                        *** YOU GOT IT ***

HOW MANY MAJOR PLANETS ARE THERE WHICH REVOLVE AROUND OUR
SUN?

? NINE
CORRECT!!!  SEE SHAWNA, LEARNING CAN ACTUALLY
BE FUN!!

NOW IN ADDITION TO THOSE NINE MAJOR PLANETS, THERE ARE ALSO
ABOUT 100,000 PLANETOIDS.  THESE ARE ALSO CALLED MINOR
PLANETS OR ASTEROIDS.  THE MAIN DIFFERENCE IS IN THEIR SIZE.
THE LARGEST OF THESE IS ABOUT THE SIZE OF OUR STATE OF
TEXAS, HOWEVER MOST OF THEM ARE NO LARGER THAN A FEW MILES
ACROSS.

WHICH ONE OF THE FOLLOWING IS NOT A NAME FOR THE MINOR
PLANETS?

                    A)  PLANETOIDS
                    B)  ASTEROIDS
                    C)  SATELLITES

? B

SHAWNA I KNOW THAT ASTEROIDS IS A DIFFICULT WORD TO
REMEMBER, BUT MAYBE IF YOU USE IT WHEN YOU SPEAK WITH YOUR
FRIENDS, A FEW TIMES, THAT WILL HELP YOU.  LET'S TRY THAT
QUESTION AGAIN.

WHICH ONE OF THE FOLLOWING IS NOT A NAME FOR THE MINOR
PLANETS?

                    A)  PLANETOIDS
                    B)  ASTEROIDS
                    C)  SATELLITES

? C

F A N T A S T I C ! ! !  THAT CORRECT ANSWER
JUST EARNED YOU (3) BONUS POINTS!!

BEFORE WE GO ANY FURTHER, LET'S REVIEW WHAT WE HAVE LEARNED
SO FAR.

THE PLANET UPON WHICH WE LIVE, EARTH, IS ONLY ONE OF NINE
PLANETS WHICH REVOLVE AROUND OUR SUN.  IN ADDITION TO
THESE NINE PLANETS, THERE ARE ALSO VERY SMALL BODIES
CALLED PLANETOIDS, MINOR PLANETS, OR ASTEROIDS.  MOST OF
THE MINOR PLANETS ARE ONLY A FEW MILES ACROSS.

  IF YOU HAVE ANY QUESTIONS ON THE MATERIAL COVERED SO FAR,
EITHER WRITE THEM DOWN OR ASK ONE OF THE AIDES TO HELP YOU.

ARE YOU READY TO GO ON SHAWNA?
? YES
```

```
WE HAVE LEARNED THAT THERE ARE NINE PLANETS WHICH REVOLVE
AROUND OUR SUN.  WOULD YOU LIKE TO TAKE A FEW MINUTES AND
LEARN A LITTLE BIT ABOUT ONE OF THEM CALLED JUPITER?

? YES

TERRIFIC SHAWNA!!  IT MAKES ME HAPPY TO SEE THAT YOU ARE
INTERESTED IN THIS SCIENCE LESSON!

JUPITER IS THE LARGEST OF ALL THE PLANETS, HOWEVER SHE HAS
THE SHORTEST 'DAY'.  IF WE MEASURE IT BY EARTH TIME,
JUPITER'S DAY WOULD LAST ONLY 9 HOURS AND 55 MINUTES!!

THINK ABOUT THAT SHAWNA!  WOULD YOU LIKE TO HAVE A DAY LAST
ONLY 10 HOURS INSTEAD OF 24?

? NO

WHY DON'T YOU WRITE A SHORT STORY ABOUT HOW YOUR LIFE WOULD
BE DIFFERENT IF THE DAY ONLY LASTED 10 HOURS.  WHEN YOU
FINISH IT, PERHAPS YOU WOULD LIKE TO READ IT TO MISS COLE
OR TO SOME OF YOUR FRIENDS.

AS WE READ EARLIER, JUPITER IS THE LARGEST PLANET.  TO
COMPARE HER TO OUR PLANET, EARTH, SHE WOULD BE ABOUT
ELEVEN TIMES GREATER IN SIZE!!  AND LISTEN TO THIS....
INSTEAD OF JUST HAVING ONE MOON, SHE HAS THIRTEEN!!!

IF YOU COULD CHOOSE, HOW MANY MOONS WOULD YOU WANT?
? 5 OR 6

THIS IS THE END OF THIS LESSON, BUT LET'S REVIEW WHAT WE
HAVE LEARNED ABOUT THE PLANET JUPITER.

JUPITER.....  IS THE LARGEST OF THE NINE PLANETS WHICH
               REVOLVE AROUND OUR SUN.

              HAS A DAY WHICH ONLY LASTS 9 HOURS AND 55
               MINUTES.

              HAS THIRTEEN MOONS.

              IS ABOUT ELEVEN TIMES AS LARGE AS THE EARTH.

TERRIFIC SHAWNA.  YOU COMPLETED THE ENTIRE
LESSON!!!

YOU EARNED  10  TOKENS TODAY!  BEFORE YOU
CLEAR THE SCREEN, MAKE SURE YOU ASK ONE OF THE AIDES TO
HELP YOU RECORD YOUR TOKENS.  TALK TO YOU LATER.
SIGNING OFF.........ASLAN.
```

Program Listing

```
10 REM
20 REM   X COUNTS THE STUDENT'S CORRECT RESPONSES
30 REM
40 X=0
90 GOTO 120
100 PRINT:PRINT:PRINT
110 RETURN
120 PRINT "            LESSON ONE OF THE WORLDS BEYOND OUR WORLD"
130 GOSUB 100
140 PRINT "OKAY, AND WHAT MIGHT BE THE NAME OF THE PERSON WHICH IS"
150 PRINT "TICKLING MY KEYS NOW?"
160 GOSUB 100
170 REM
180 REM   Z$ IS THE VARIABLE NAME FOR THE STUDENT'S NAME. THE STUDENT
190 REM   WILL BE REFERRED TO BY HIS OR HER NAME THROUGHOUT THE LESSON.
200 REM
210 INPUT Z$
220 GOSUB 100
230 PRINT "OKAY "; Z$; ", LET'S SEE IF WE CAN'T LEARN ABOUT"
240 PRINT "OUR SOLAR SYSTEM."
250 GOSUB 100
260 PRINT" THE PLANET OF WHICH WE ARE MOST FAMILIAR IS THE EARTH.  THIS
270 PRINT "IS ONLY ONE OF THE NINE MAJOR PLANETS WHICH REVOLVE AROUND"
280 PRINT "OUR SUN."
290 GOSUB 100
300 REM
310 REM   ASK THE QUESTION...
320 REM
330 PRINT "WHAT IS THE NAME OF THE PLANET UPON WHICH WE LIVE?"
340 GOSUB 100
350 REM
```

check is a good example of token reinforcement.)

Do not let the program's specifics dampen the potential use of a microcomputer system in your classroom or home. This is only a single example; the potential for this system is limited only by your imagination and the software programs you build.

Controlling both the stimulus which precedes the response and also that which follows facilitates learning. Being able to ask the same question in many different ways is essential. All children do not have the same learning style. Some need visual as well as written stimuli; others need concrete objects to be introduced before they can conceptualize what is being presented. Know a child's learning style to best prepare materials through which he will be taught. Alternative presentations should be available in computer programs so that every child is given several opportunities for success.

The consequence to the child's response, or the immediate reinforcement, should also be carefully programmed. The poor student encounters enough negativity when he fails in school. His experience with computerized instruction should be positive. Here is a chance for any student to feel free to express himself when working with the computer. No matter how many times he misses a question, the computer will not scoff at him nor will he be humiliated in front of his peers. Computerized instruction can be a source of good feelings for the child, positive immediate reinforcement and a channel through which the child can obtain secondary reinforcers, such as certain privileges.

Based upon the model introduced by B.F. Skinner for programmed instruction, computerized learning is a simple step-by-step procedure giving the child a near optimal chance for immediate reinforcement. The student gets just enough information at each step to minimize the chance of an incorrect answer. The method insures the child's active participation, presents material at the student's own pace and style and allows for both immediate and latent reinforcement.

Though based on Skinner's model, CAI has many definite advantages. When a child works with a computer, the

learning situation is far more interactive. The computer can be made to actually converse with the student.

A CAI program can keep track of the student's progress, pinpoint problem areas, and allow the child to branch – to go into more depth on a particular subject.

Branching can also be applied to reinforcing or pleasurable routines once a student attains a particular number of correct answers, perhaps with a routine which plays a game such as Hangman (which could also teach spelling) or Cubic (a three-dimensional tic-tac-toe, which could stimulate new thinking strategies or methods).

It won't be long before joysticks and TV ping-pong games are standard items on personal computers. When this happens even more possibilities arise for stimulating new interest in computer lessons, especially for children who are hard to reach with conventional teaching methods.

Keep in mind that basic educational and psychological principles lie behind the strategies used in writing CAI programs. Take a look at the sample program run and listing. Addressing the student by name in the lesson maintains his attention. Also, different words are used for reinforcing a correct answer, while different methods of presentation are used when an incorrect answer is typed in. When asking for an answer, the computer tests free recall by having the student type in a word or number. Multiple-choice questions help the student discriminate between the correct answer and other suggested answers which are possibly close in meaning or content.

Notice also that a counter, "X", is initialized (set to zero) at the beginning of the program to keep track of the student's correct answers. No penalizing or taking away of points results from incorrect responses; the program continues to provide the child with cues or hints until he responds with the correct answer. □

```
360 REM   GET THE ANSWER.
370 REM
380 INPUT A$
390 GOSUB 100
400 REM
410 REM   IS IT CORRECT ?  IF SO, COUNT CORRECT ANSWER AND OUTPUT
420 REM   REINFORCEMENT.
430 REM
440 IF A$= "EARTH" THEN GOTO 480
450 PRINT "COME ON "; Z$; ", THAT WAS AN EASY ONE.  LET'S"
460 PRINT "READ THAT PARAGRAPH AGAIN!"
470 GOTO 250
480 X=X+1:GOSUB 1950
490 GOSUB 100
500 PRINT "HOW MANY MAJOR PLANETS ARE THERE WHICH REVOLVE AROUND OUR"
510 PRINT "SUN?"
520 GOSUB 100
530 INPUT A$
540 IF A$ ="9" THEN GOTO 880
550 IF A$="NINE" THEN GOTO 880
560 PRINT "MAYBE IF WE TRY THAT QUESTION IN A DIFFERENT WAY, IT MIGHT"
570 PRINT "BE EASIER."
580 GOSUB 100
590 PRINT "WHICH ONE OF THE FOLLOWING REPRESENTS THE NUMBER OF PLANETS"
600 PRINT "WHICH REVOLVE AROUND OUR SUN?"
610 PRINT "               A) EARTH IS THE ONLY PLANET WHICH REVOLVES
620 PRINT "                  AROUND THE SUN."
630 PRINT "               B) NINE"
640 PRINT "               C) TWENTY-FOUR"
650 GOSUB 100
660 INPUT A$
670 GOSUB 100
680 IF A$="B" THEN GOTO 880
690 PRINT "LET'S READ THAT PARAGRAPH OVER AGAIN AND SEE IF WE CAN'T"
700 PRINT "FIND THAT ANSWER."
710 GOSUB 100
720 PRINT "THE PLANET OF WHICH WE ARE MOST FAMILIAR IS THE EARTH.  THIS
730 PRINT "IS ONLY ONE OF THE NINE MAJOR PLANETS WHICH REVOLVE AROUND"
740 PRINT "OUR SUN."
750 GOSUB 100
760 PRINT "NOW IF WE READ THIS PARAGRAPH CAREFULLY, "; Z$
770 PRINT "WE CAN SEE THAT THERE ARE (       ) PLANETS WHICH REVOLVE"
780 PRINT "AROUND OUR SUN."
790 GOSUB 100
800 INPUT A$
810 GOSUB 100
820 IF A$ ="NINE" THEN GOTO 880
830 IF A$ ="9" THEN GOTO 880
840 PRINT "NOT QUITE "; Z$; " THERE ARE NINE PLANETS WHICH REVOLVE AROU
850 PRINT "OUR SUN.  REPEAT THAT NUMBER SO THAT YOU WILL REMEMBER IT."
860 PRINT "                NINE!!!!"
870 GOTO 900
880 PRINT "CORRECT!!!  YOU'RE DOING PRETTY GOOD, "; Z$
890 PRINT "BE FUN!!":X=X+1
900 PRINT
910 PRINT "NOW IN ADDITION TO THOSE NINE MAJOR PLANETS, THERE ARE ALSO"
920 PRINT "ABOUT 100,000 PLANETOIDS.  THESE ARE ALSO CALLED MINOR "
930 PRINT "PLANETS OR ASTEROIDS.  THE MAIN DIFFERENCE IS IN THEIR SIZE.
940 PRINT "THE LARGEST OF THESE IS ABOUT THE SIZE OF OUR STATE OF "
950 PRINT "TEXAS, HOWEVER MOST OF THEM ARE NO LARGER THAN A FEW MILES "
960 PRINT "ACROSS."
970 GOSUB 100
980 PRINT "WHICH ONE OF THE FOLLOWING IS NOT A NAME FOR THE MINOR"
990 PRINT "PLANETS?  (ANSWER WITH THE LETTER OF THE RIGHT ANSWER)"
1000 GOSUB 100
1010 PRINT "                    A)  PLANETOIDS"
1020 PRINT "                    B)  ASTEROIDS"
1030 PRINT "                    C)  SATELLITES"
1040 GOSUB 100
1050 INPUT A$
1060 GOSUB 100
1070 IF A$="C" THEN PRINT "F A N T A S T I C ! ! !  THAT CORRECT ANSWER"
1080 IF A$="C" THEN PRINT "JUST EARNED YOU (3) BONUS POINTS!!":GOTO 1250
1090 IF A$ ="A" THEN GOTO 1150
1100 PRINT Z$; " I KNOW THAT ASTEROIDS IS A DIFFICULT WORD TO"
1110 PRINT "REMEMBER, BUT MAYBE IF YOU USE IT WHEN YOU SPEAK WITH YOUR"
1120 PRINT "FRIENDS, A FEW TIMES, THAT WILL HELP YOU.  LET'S TRY THAT"
1130 PRINT "QUESTION AGAIN."
1140 GOTO 970
1150 PRINT
1160 PRINT "LOOK AT THE WORD 'PLANETOIDS' VERY CLOSELY.  LET'S BREAK IT"
1170 PRINT "UP INTO TWO SEGMENTS OF THE WORD.  WE WOULD THEN HAVE"
1180 PRINT
1190 PRINT "                        PLANET    OIDS"
1200 PRINT
```

```
1210 PRINT " THE FIRST SEGMENT OF THAT WORD IS PLANET.  REMEMBER THAT"
1220 PRINT " WHEN WE GO BACK TO THE QUESTION.  NOW LET'S TRY IT AGAIN "
1230 PRINT " ";Z$
1240 GOTO 970
1250 X=X+3:GOSUB 100
1260 PRINT" BEFORE WE GO ANY FURTHER, LET'S REVIEW WHAT WE HAVE LEARNED"
1270 PRINT" SO FAR."
1280 GOSUB 100
1290 PRINT"  THE PLANET UPON WHICH WE LIVE, EARTH, IS ONLY ONE OF NINE"
1300 PRINT"  PLANETS WHICH REVOLVE AROUND OUR SUN.  IN ADDITION TO "
1310 PRINT"  THESE NINE PLANETS, THERE ARE ALSO VERY SMALL BODIES "
1320 PRINT"  CALLED PLANETOIDS, MINOR PLANETS, OR ASTEROIDS.  MOST OF "
1330 PRINT"  THE MINOR PLANETS ARE ONLY A FEW MILES ACROSS."
1340 GOSUB 100
1350 PRINT"  IF YOU HAVE ANY QUESTIONS ON THE MATERIAL COVERED SO FAR,"
1360 PRINT "EITHER WRITE THEM DOWN OR ASK ONE OF THE AIDES TO HELP YOU.
1370 GOSUB 100
1380 PRINT "ARE YOU READY TO GO ON "; Z$; "?"
1390 INPUT A$
1400 IF A$="NO" THEN GOTO 1890
1410 GOSUB 100:GOSUB 100:GOSUB 100
1420 PRINT " WE HAVE LEARNED THAT THERE ARE NINE PLANETS WHICH REVOLVE"
1430 PRINT " AROUND OUR SUN.  WOULD YOU LIKE TO TAKE A FEW MINUTES AND"
1440 PRINT " LEARN A LITTLE BIT ABOUT ONE OF THEM CALLED JUPITER?"
1450 GOSUB 100
1460 INPUT A$
1470 IF A$ ="NO" THEN GOTO 1890
1480 GOSUB 100
1490 PRINT "TERRIFIC "; Z$; "!!  IT MAKES ME HAPPY TO SEE THAT YOU ARE"
1500 PRINT "INTERESTED IN THIS SCIENCE LESSON!":X=X+3
1510 GOSUB 100
1520 PRINT "JUPITER IS THE LARGEST OF ALL THE PLANETS, HOWEVER SHE HAS"
1530 PRINT "THE SHORTEST 'DAY'.  IF WE MEASURE IT BY EARTH TIME, "
1540 PRINT "JUPITER'S DAY WOULD LAST ONLY 9 HOURS AND 55 MINUTES!!"
1550 GOSUB 100
1560 PRINT "THINK ABOUT THAT "; Z$; "!  WOULD YOU LIKE TO HAVE A DAY LAST
1570 PRINT "ONLY 10 HOURS INSTEAD OF 24?"
1580 GOSUB 100
1590 INPUT A$
1600 GOSUB 100
1610 PRINT "WHY DON'T YOU WRITE A SHORT STORY ABOUT HOW YOUR LIFE WOULD
1620 PRINT "BE DIFFERENT IF THE DAY ONLY LASTED 10 HOURS.  WHEN YOU"
1630 PRINT "FINISH IT, PERHAPS YOU WOULD LIKE TO READ IT TO MISS COLE "
1640 PRINT "OR TO SOME OF YOUR FRIENDS."
1650 GOSUB 100
1660 PRINT "AS WE READ EARLIER, JUPITER IS THE LARGEST PLANET.  TO"
1670 PRINT "COMPARE HER TO OUR PLANET, EARTH, SHE WOULD BE ABOUT"
1680 PRINT "ELEVEN TIMES GREATER IN SIZE!!  AND LISTEN TO THIS...."
1690 PRINT "INSTEAD OF JUST HAVING ONE MOON, SHE HAS THIRTEEN!!!"
1700 PRINT
1710 PRINT "IF YOU COULD CHOOSE, HOW MANY MOONS WOULD YOU WANT?"
1720 INPUT A$
1730 PRINT
1740 PRINT "THIS IS THE END OF THIS LESSON, BUT LET'S REVIEW WHAT WE"
1750 PRINT "HAVE LEARNED ABOUT THE PLANET JUPITER."
1760 PRINT
1770 PRINT "JUPITER.....  IS THE LARGEST OF THE NINE PLANETS WHICH"
1780 PRINT "               REVOLVE AROUND OUR SUN."
1790 PRINT
1800 PRINT "              HAS A DAY WHICH ONLY LASTS 9 HOURS AND 55"
1810 PRINT "               MINUTES."
1820 PRINT
1830 PRINT "              HAS THIRTEEN MOONS."
1840 PRINT
1850 PRINT "              IS ABOUT ELEVEN TIMES AS LARGE AS THE EARTH."
1860 PRINT
1870 PRINT "TERRIFIC "; Z$; ".  YOU COMPLETED THE ENTIRE "
1880 PRINT "LESSON!!!":X=X+2
1890 PRINT
1900 PRINT "YOU EARNED "; X; " TOKENS TODAY!  BEFORE YOU"
1910 PRINT "CLEAR THE SCREEN, MAKE SURE YOU ASK ONE OF THE AIDES TO"
1920 PRINT "HELP YOU RECORD YOUR TOKENS.  TALK TO YOU LATER."
1930 PRINT "SIGNING OFF.....ASLAN.
1940 END
1950 PRINT;;"* * * *   *    * * * *       * * *    *      *  * * * * !!
1960 PRINT;;"*        * *   *     *      *     *   *      *     *    !!
1970 PRINT;;"*       *   *  *     *      *     *   *      *     *    !!
1980 PRINT;;"* *    * * * * * * *       *     *   *      *     *    !!
1990 PRINT;;"*      *     * *    *       *     *   *      *     *
2000 PRINT;;"*      *     * *     *       * * *     * * *       *    !!
2010 PRINT
2020 PRINT;;"                                          *** YOU GOT IT ***"
2030 RETURN
```

COMPUTER EDUCATION FOR ALL

Touch-typing gives you quicker, easier access to your computer. It's like having

A Magic Touch

BY KEVIN STUMPF

Today, educated people need to know the capabilities of computers and how to use them. But knowing how to use computers is not enough. To enter programs and data, you must gain access to to the system in a quick, simple, straightforward manner.

Punched cards, paper tape and batch processing lie in the past; today's interactive terminals possess keyboards to let you tell the computer what you want it to do. So educated people today need to know how to touch type – otherwise, using a computer will prove a slow, inefficient, frustrating process.

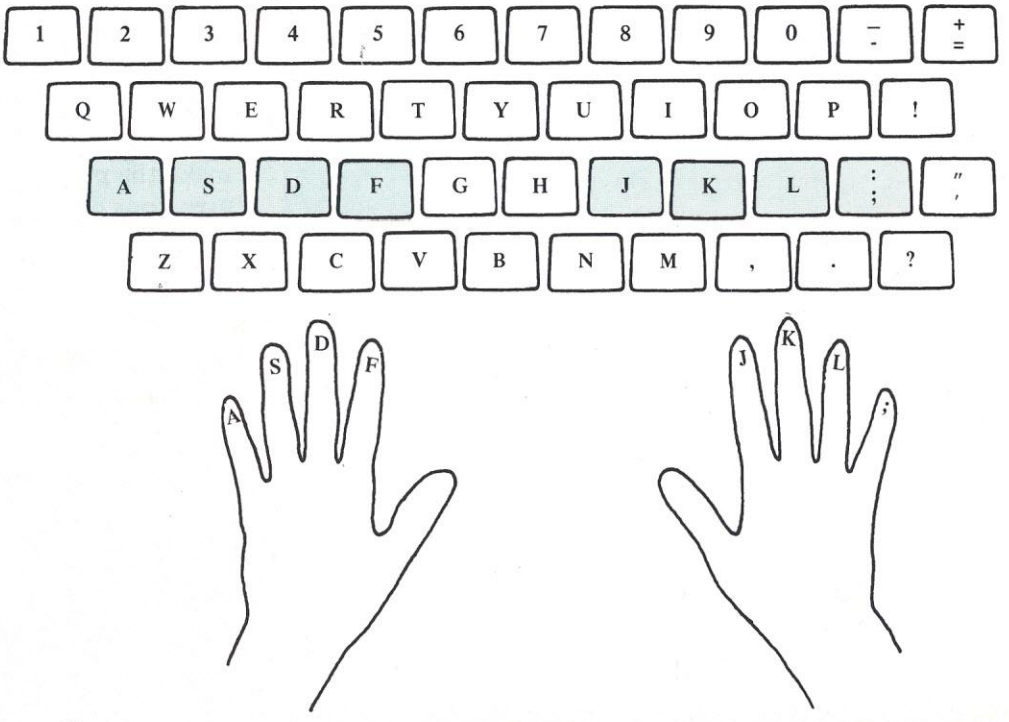
Touch typing is entering text via a keyboard using all ten fingers and not constantly looking at the keyboard to search out each character. Just think of it, you hackers – keying a 500 line BASIC program in under 20 minutes!

Normally you learn touch typing in a classroom where you perform drills supervised by a pointer-wielding instructor. The instructor points out a character on a large poster of a standard keyboard and you depress that key while your eyes follow the instructor's pointer. Eventually you learn where the keys are and progress to typing words, sentences and paragraphs.

Why not replace the instructor, the poster and even the typewriter with your microcomputer, a simple program and a video display terminal?

The benefits of knowing how to type

Figure 1



should motivate you to develop your own teaching programs. But, once developed, these programs can teach your children touch typing as well.

The first lesson in touch typing is learning the home group of keys. Figure 1 shows the correspondence between your fingers and the home group. Your fingers always rest on these keys. After striking a key, they return to home position before striking the next. Your fingers learn to locate different keys by their proximity to the home group of keys. Figure 2 shows the internationally standard finger-to-key assignments.

You could easily write a series of programs to drill you on the various aspects of touch typing. Drills should start by simply displaying a character on the screen and waiting for you to acknowledge. After you've keyed in a character, the program will verify it as correct. If the entry was incorrect, the program should instruct you to reenter the character until it is correct. Upon a correct entry, the program requests another character. The program for this stage should request the characters in a sequence that follows the key-to-finger assignments. See Sample Drills in Figure 2.

Next, another drill program should display a complete word, which you type in. Again the program compares the characters you entered to what was requested. If a character-by-character search shows a mismatch, a short message is displayed and you're given another chance.

While interacting with your computer, you should keep your fingers in the home position and your eyes on the screen. Using this method, you learn touch typing with the program acting as your instructor.

For the next drill, advance to complete sentences and paragraphs. All the while, your eyes should remain glued to the screen. At the end of the exercise, the program should check for errors and give you another drill or request a repeat of the same drill.

In keeping with standard training approaches, I recommend you use a timing loop so you must respond within a specific time period. For instance, only allow one second for a response during the single character drills. Failing to respond within that time will be regarded as an error. Next, apply the timing concept to paragraphs. Allow a certain length of time to complete the paragraph. This method not only gives you incentive, but allows you to calculate your words-per-minute score by counting the total number of correct characters, dividing that sum by five and finally dividing that result by the total number of minutes.

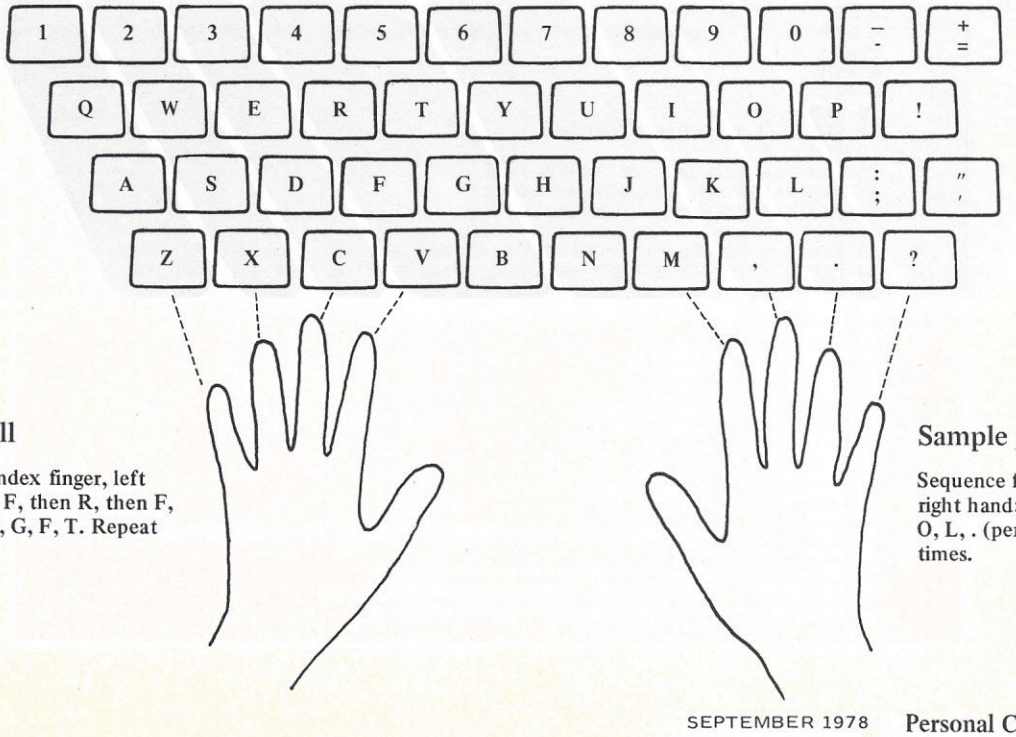
For that matter, why not have the program perform the words-per-minute calculation?

Assembler, the ideal programming language for this application, gives you complete control over the timing loop before you request the next character. BASIC will fulfill all the requirements of the application except the character will automatically be displayed when you touch the key. In BASIC, the text of the drills could be contained in an array, each character an element of the array.

To make the system conversational, use the menu approach to drill selection. For instance, make descriptions of the various drills appear on the screen with numbers assigned to each one. At the bottom of the screen, you key in the assigned number of the desired drill. Carriage returns should be included as a character. You might find it handy in the timed drills to have a special character defining the end of the text. Also note that many "standard" keyboard configurations exist so the finger-to-key assignment may differ slightly on your system.

Touch typing can free you from hunting and pecking when entering and running your programs. So why not let your computer teach you this skill? □

Figure 2



Sample Drill

Sequence for index finger, left hand: Request F, then R, then F, then V, then F, G, F, T. Repeat 20 times.

Sample Drill

Sequence for third finger, right hand: Request L, then O, L, . (period). Repeat 20 times.

Sample Run

```
*****************************
 YOUR TYPING TEACHER IS READY
*****************************

 START WITH THE ALPHABET DRILL

PLEASE ENTER WHICH HAND (R - RIGHT OR L - LEFT) -
                                                  R
NOW ENTER THE FINGER (1 FOR BABY DOWN TO 4 FOR INDEX) -
                                                    4
OK LET'S GO!
                                J
J                               J
J                               U
U                               J
J
                                6
6                               H
H

*****************************
 YOUR TYPING TEACHER IS READY
*****************************

 START WITH THE ALPHABET DRILL

PLEASE ENTER WHICH HAND (R - RIGHT OR L - LEFT) -
                                                  S
PLEASE ENTER WHICH HAND (R - RIGHT OR L - LEFT) -
                                                  L
NOW ENTER THE FINGER (1 FOR BABY DOWN TO 4 FOR INDEX) -
                                                    9
NOW ENTER THE FINGER (1 FOR BABY DOWN TO 4 FOR INDEX) -
                                                    2
OK LET'S GO!
                                S
S
                                2
2                               S
S
```

Program Listing

```
1 REM       *  BEGINNING OF A TOUCH TYPING INSTRUCTION PROGRAM
2 REM       *
3 REM       *  WRITTEN IN NORTH STAR BASIC
4 REM       *  DEVELOPED ON COMPUTER MARKETS MICRO Z-80 COMPUTER
5 REM       *
6 REM       *  KEYBOARD LAYOUT FROM VOLKER-CRAIG VC303A VIDEO TERMINAL
7 REM       *
8 REM
9 REM
10 REM   *
11 REM   * ALLOCATE STORAGE
12 REM   *
13 DIM L1$(4),L2$(4),L3$(4),L4$(8)
15 DIM R1$(6),R2$(4),R3$(4),R4$(8)
20 DIM T1$(8),H1$(1),B1$(40)
22 REM   *
23 REM   * ESTABLISH SEQUENCE OF CHARACTERS FOR DRILLS - L & R
24 REM   * INDICATE LEFT OR RIGHT HAND AND THE NUMBERS INDICATE
25 REM   * THE FINGER SELECTION - 1 IS FOR BABY FINGERS AND
26 REM   * DOWN TO 4 FOR THE INDEX FINGER
27 REM   *
30 L1$(1,4) = "AQZ1"
31 L2$(1,4) = "SWX2"
32 L3$(1,4) = "DEC3"
33 L4$(1,8) = "FRV4GTB5"
34 R1$(1,6) = ";P/0:-"
35 R2$(1,4) = "LO.9"
36 R3$(1,4) = "KI,8"
37 R4$(1,8) = "JUM7HYN6"
40 REM   *
41 REM   *  PRINT HEADINGS AND PROMPT STUDENT TO SETUP DRILL
42 REM   *
50 PRINT#7,"*****************************"
55 PRINT#7," YOUR TYPING TEACHER IS READY "
60 PRINT#7,"*****************************"
```

Program Listing continued

```
65 PRINT#7,
70 PRINT#7," START WITH THE ALPHABET DRILL"
75 PRINT#7,
80 PRINT#7,"PLEASE ENTER WHICH HAND (R = RIGHT OR L
     = LEFT) - "
81 INPUT H1$
82 PRINT#7,TAB(60),H1$
83 REM   *
84 REM   *  TEST FOR VALID INPUT PARAMETER'S SUPPLIED
     BY STUDENT
85 REM   *
86 IF H1$ <> "R" THEN IF H1$ <> "L" THEN 80
90 IF H1$ = "R" THEN H1 = 0 ELSE H1 = 4
95 PRINT#7,"NOW ENTER THE FINGER (1 FOR BABY DOWN TO 4
     FOR INDEX) - "
96 INPUT H2
97 PRINT#7,TAB(70),H2
100 IF H2 > 4 THEN 95
105 ON (H1 + H2) GOTO 1000,2000,3000,4000,5000,6000,
     7000,8000
110 REM   *
111 REM   *  BASED ON STUDENT INPUT SETUP DRILL
112 REM   *
1000 C1 = 6
1005 T1$(1,6) = R1$(1,6)
1010 GOTO 9000
2000 C1 = 4
2005 T1$(1,4) = R2$(1,4)
2010 GOTO 9000
3000 C1 = 4
3005 T1$(1,4) = R3$(1,4)
3010 GOTO 9000
4000 C1 = 8
4005 T1$(1,8) = R4$(1,8)
4010 GOTO 9000
5000 C1 = 4
5005 T1$(1,4) = L1$(1,4)
5010 GOTO 9000
6000 C1 = 4
6005 T1$(1,4) = L2$(1,4)
6010 GOTO 9000
7000 C1 = 4
7005 T1$(1,4) = L3$(1,4)
7010 GOTO 9000
8000 C1 = 8
8005 T1$(1,8) = L4$(1,8)
8990 REM   *
8991 REM   *  C2 POINTS TO THE HOME POSITION CHARACTER
8992 REM   *
9000 C2 = 1
9001 PRINT#7,"OK LET'S GO!"
9050 REM   *
9051 REM   *  NOW LOOP THROUGH THE CHARACTERS WHICH
9052 REM   *  CORRESPOND TO THE SELECTED DRILL.  PROMPT
9053 REM   *  THE STUDENT TO ENTER THE SELECTED CHARACTER
9054 REM   *  AND TEST FOR A CORRECT RESPONSE.  BETWEEN
9055 REM   *  EACH CHARACTER REPEAT THE HOME POSITION
9056 REM   *  CHARACTER.
9057 REM   *
9100 FOR I = 1 TO C1
9105     PRINT#7,TAB(30),T1$(I,I)
9110     INPUT B1$
9111     PRINT#7,B1$
9112     REM   *
9113     REM   *  ALLOW FOR STRIKING MULTIPLE KEYS
           IN THE EARLY STAGES
9114     REM   *
9115     IF LEN(B1$) > 1 THEN 9105
9120     IF B1$(1,1) <> T1$(I,I) THEN 9105
9121     REM   *
9122     REM   *  TEST TO SEE IF HOME POSITION
           HAS CHANGED
9123     REM   *
9130     IF I = 5 THEN C2 = 5
9135     PRINT#7,TAB(30),T1$(C2,C2)
9140     INPUT B1$
9141     PRINT#7,B1$
9145     IF LEN(B1$) > 1 THEN 9135
9150     IF B1$(1,1) <> T1$(C2,C2) THEN 9135
9200 NEXT
```

COMPUTER EDUCATION FOR ALL

Spelling Bee for a PET

BY MICHAEL TULLOCH

Have you been looking for a way to justify buying a computer or a video monitor to your spouse? Here's one way if you've got a young reader who needs help in spelling.

This program allows Mom or Dad to type in a list of words – as many words as you want. The young reader then types in RUN. A line is printed on the monitor's screen. The first word on the list replaces the line for about 1/6 of a second. Then the screen goes blank. Our young reader can now type in the word. The computer compares his word letter by letter with the presented word and prints messages based on the number of letters in the same position within the two words.

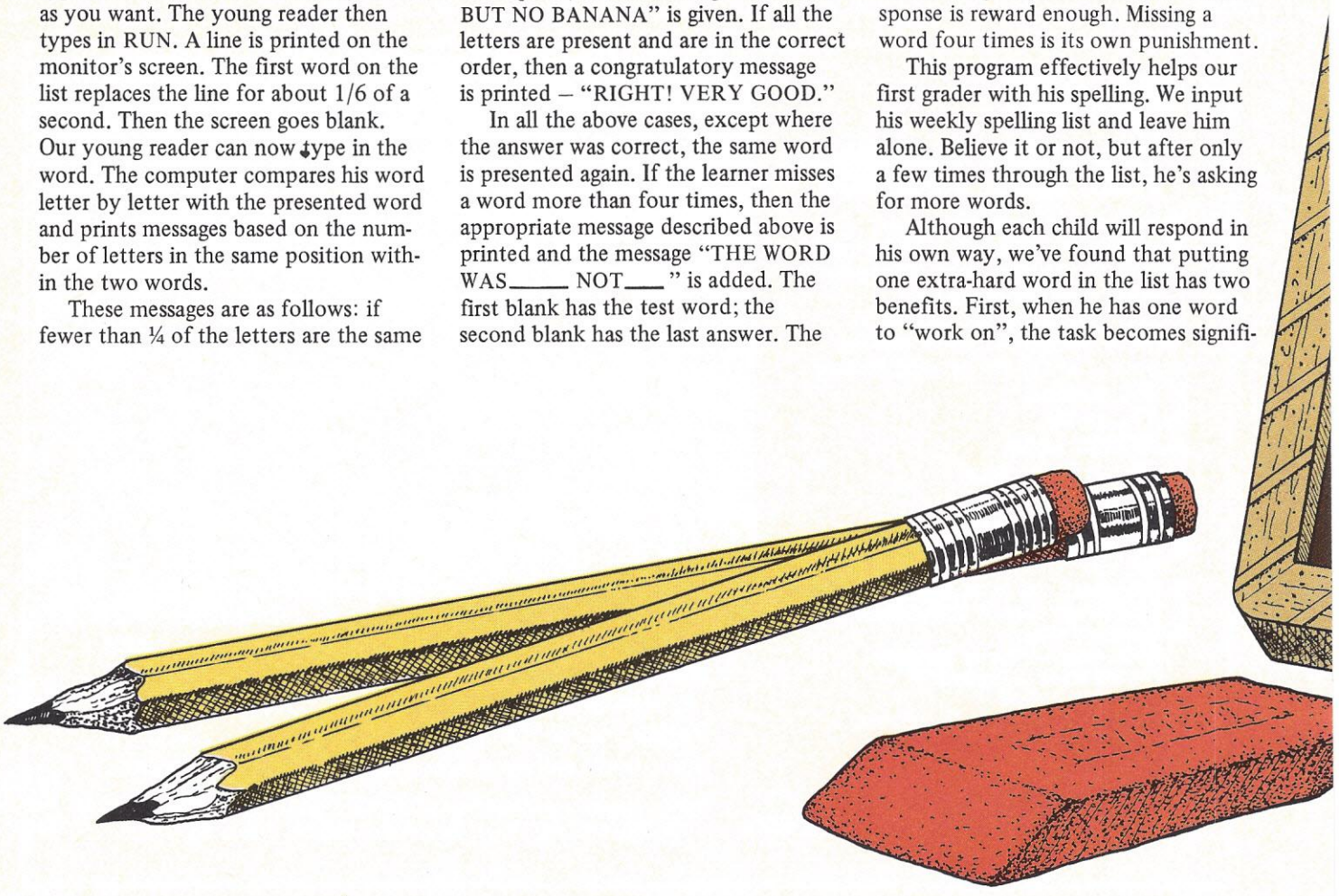
These messages are as follows: if fewer than ¼ of the letters are the same and in the same order, the program prints "NOT EVEN CLOSE. TRY AGAIN." If between ¼ and ¾ of the letters agree, then "A FEW LETTERS ARE THE SAME, TRY AGAIN" is printed. If three quarters of the letters correspond, the the message "CLOSE, BUT NO BANANA" is given. If all the letters are present and are in the correct order, then a congratulatory message is printed – "RIGHT! VERY GOOD."

In all the above cases, except where the answer was correct, the same word is presented again. If the learner misses a word more than four times, then the appropriate message described above is printed and the message "THE WORD WAS_____ NOT____ " is added. The first blank has the test word; the second blank has the last answer. The entire procedure repeats.

No scoring is used for two reasons. First, low scores discourage beginning readers. In fact, youngsters may not understand the purpose of a score. After all, we're trying to make reading and spelling fun. Second, a correct response is reward enough. Missing a word four times is its own punishment.

This program effectively helps our first grader with his spelling. We input his weekly spelling list and leave him alone. Believe it or not, but after only a few times through the list, he's asking for more words.

Although each child will respond in his own way, we've found that putting one extra-hard word in the list has two benefits. First, when he has one word to "work on", the task becomes signifi-



cantly more challenging. Second, if that word is near the end of the list then he must spell all the other words to get to the difficult one. Repetition is thus palatably provided.

You can make this program considerably more complex. Words can be weighted in their frequency of appearance based upon how often they are misspelled or how many letters are missed. You can vary the time of presentation as a function of response time or number of errors.

Scoring, record keeping, error analysis – all can be programmed.

But, while some of these ideas may be fun to add on, from my experience you should expect little increase in effectiveness.

Above all, remember the program should remain easy to use, simple in format and fun. If it's fun it will be used. If it's used it will aid learning. If learning occurs you'll have a happier spouse. If you have a happier spouse you can buy a printer, or add memory, or get that disk or . . . □

PROGRAM NOTES

Although I originally wrote this program for the PET, I've rewritten it into a more universal format. None of the PET's special cursor controls are used except "clear screen".

Line 5 initializes the on time of the word by setting A equal to 10. F counts the number of misses.

Lines 10 through 99 are DATA statements containing the words to be spelled. Note that the last word should be END if you want the list to repeat. If END is not used, then an insufficient data or read error will terminate the program after the last word.

Lines 100 through 110 read the data into A$ and check for the end of the list.

Line 120 wastes time so that any previous message can be read. You may wish to increase this time.

Lines 122 through 130 print the cue line.

Line 140 wastes time to display the cue line.

Line 150 sets the variable TS equal to the current time (TI on the PET). If your machine doesn't have a real-time clock, eliminate this line and replace line 160 with a FOR-NEXT timing loop.

Line 155 prints A$ and blanks out the remaining part of the cue line.

Lines 165 through 170 clear the screen and accept the young reader's trial spelling.

Lines 200 through 280 check the number of letters which are correct and display the appropriate message.

Lines 320 through 360 count the number of times a word is misspelled and either give the correct spelling with the last try or cause the word to be repeated.

PROGRAM LISTING

```
 5 A=10:F=0
 10 DATA
100 READ A$
110 IF A$ = "END" THEN RESTORE: GOTO 100
120 FOR I = 1 TO 900 : NEXT I
122 PRINT CLS: PRINT TAB (250);
125 N=0
130 PRINT "_____"
140 FOR I=0 TO 990: NEXT I
150 TS = TI
155 PRINT CLS : PRINT TAB (250); A$; "      "
160 IF TI - TS = A THEN 160
165 PRINT CLS
170 INPUT B$
200 IF A$ = B$ THEN PRINT "RIGHT!  VERY GOOD.": GOTO 100
210 FOR L = 1 TO LEN(A$)
220 IF MID$(A$,L,1) = MID$(B$,L,1) THEN N = N + 1
230 NEXT L
240 ON INT(N*4/L) GOTO 250,260,270,280
250 PRINT"NOT EVEN CLOSE TRY AGAIN.": GOTO 320
260 PRINT"SOME LETTERS RIGHT, TRY AGAIN.": GOTO 320
270 PRINT"PRETTY GOOD, BUT TRY AGAIN.": GOTO 320
280 PRINT"CLOSE, BUT NO BANANA. TRY AGAIN.": GOTO 320
320 F = F + 1
330 IF F = 4 THEN 120
340 PRINT "THE WORD WAS "; A$ ; "NOT ";B$
350 FOR I = 1 TO 999 : NEXT I
360 GOTO 100
```

Illustration by Susan Howard

Needlework is only one of many potential uses for the Dazzler and Linda Schreiber's Graphics language. Cromemco's Dazzler, a two-board I/O device that plugs into the S100 bus on your microcomputer, excites the imagination with possible applications from landscape planning to interior decorating; from charts and graphs to maps and diagrams; from industrial training to complex technological displays.

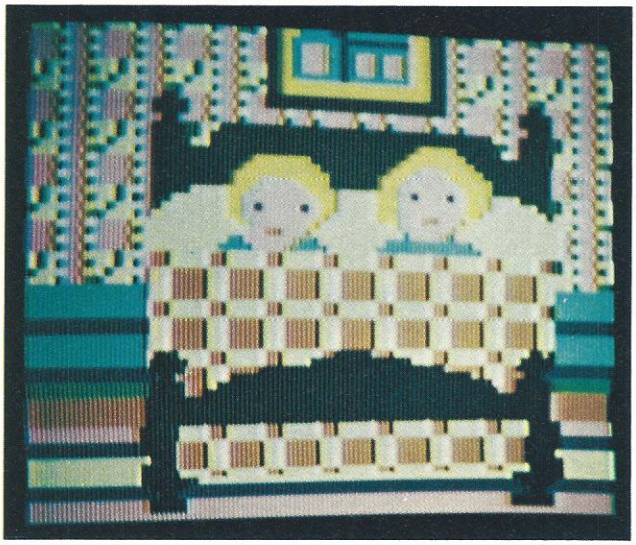
Graphics, a versatile Dazzler language, lends itself to numerous applications, limited only by your imagination. Consider these examples:

Your home need a face lift? Use your Dazzler to plan your landscape. Figure a big 12-foot diameter (including branches) willow over here, a flame red rhododendron over there, and a line of privet from hither to yon.

When you're finished, you can develop the modifications that will allow you to transform your cape into a finished two-story home with dormers. Now, use these techniques to lay out and develop decorating schemes for each room.

That regional sales meeting next month haunts you with its scores of charts, graphs and district maps you must make. But don't worry; let your Dazzler assist you, and you can create a stunning presentation.

When you need to communicate ideas visually, Cromemco's Dazzler, Linda Schreiber's software and your own modifications can make your *CRT* come to life.



DAZZLER GRAPHICS

BY LINDA M. SCHREIBER

Needlework, in its various forms, is one of the most popular hobbies today. Men as well as women produce beautiful works of art with canvas and yarn. Most rely on kits or books and magazines for their designs, because custom-designed needlework meant drawing and redrawing designs on graph paper – a tedious, time-consuming chore. But now personal computers can help you design your own creations.

Good design depends on artistically combining colors and shapes, creating pictures by connecting tiny squares on a grid. You can make attractive designs by paying close attention to basic shapes and forms.

Vivid color graphics is one of the features that attracted me to computers. Cromemco's Dazzler, in particular, made me realize that my computer could help me develop my own needlepoint creations. I could view patterns from books or original material on my screen and modify them until I was satisfied with the results.

To my dismay, I found no software available to meet those needs. I needed a program that could plot lines or line segments on the screen at any given location. I also needed a hard copy of the design to provide a detailed worksheet of the video display. This worksheet could be used in any work that uses a grid for its design (knitting, crocheting, rughooking and cross-stitching, to name a few).

Graphics, a versatile Dazzler language, lends itself to numerous applications, limited only by your imagination.

Dazzler is a two-board color module that can output various types of displays to a color television screen. The type of display depends on how the unit is initialized. The picture can be black and white or color. The amount of memory displayed can be either 512 bytes or 2K. You can set resolution to either normal or x4. With normal resolution, each byte in the memory locations to be displayed is read as 2 four-bit words. In x4 resolution each bit of every byte in the displayed memory is turned on when the bit is "1" and off when the bit is "0". A program displaying 2K of memory allows more details in the picture than a display in normal resolution displaying 512 bytes. In most of my graphic displays, I use normal resolution and 2K of memory.

You can program the Dazzler in either BASIC or Assembly Language. Both have their advantages and disadvantages. Because it is faster in execution time, and because I feel that I have a better command of my display with it, I usually use Assembly Language.

The Dazzler can generate 16 different colors, including white and black. The colors generated depend on the binary value in the memory locations. It's interesting (and important) to note that the Dazzler reads the binary bits from the least significant bit to the most significant bit when set for normal resolution. Each memory location can be set for one or two colors. Therefore, if you want to view a particular location as red/blue, the byte should be coded blue/red.

Although Dazzler colors stay fairly constant from television set to television set, expect some variance in hues due to color, brightness and tint control adjustments. What appeared to be a cream color on my home television set turned light yellow when I took my computer to an Art Fair and used the television that was provided.

When displaying 2K of memory in normal resolution, the Dazzler has a display area of 64 x 64 units. However, the display area is divided into quadrants, each consisting of 1/2K of successive memory locations. If you were to output a line that crossed from one quadrant to another, care must be taken to increment or decrement the high and low order memory addresses accordingly. Quadrant addresses must be taken into consideration when writing programs or the results can be frustrating.

After learning how to maneuver between the quadrants, I wrote a programming language providing me with the commands needed to generate designs I could use in various art forms.

"Graphics", my programming language, lets you draw color designs on the screen of a color television by means of plot commands. While only one of many potential applications, needlework design illustrates the versatility and use of "Graphics".

This language allows you to choose any location and plot either vertical or horizontal lines. I find a 64 x 64 or 32 x 32 unit grid helpful when designing. Covering it with plastic and using a grease pencil for notations lets you use the grid over and over again.

"Graphics" uses direct, one letter commands. Each command, except for the C (color) command, is independent of the others. "Graphics" allows you to select the size of the display area (2K or 512 bytes) and color or black and white. The program sets resolution for normal; 2K allows for more detail in the design than 512 bytes.

After initializing the Dazzler, the program prompts you with a "*", putting you in command. To design with the program, select the color by typing "C" (color code). The codes for the colors are: W = white, T = turquoise, R = red, PU = purple, PI = pink, O = orange, M = maize, LG = light green, LI = lilac, G = green, BR = bright blue, BK = black and B/ = blue/green.

You must specify a color before typing "F", which fills the entire screen with the color preceding the command. Anything previously drawn on the screen will remain intact. "N" clears the entire screen for a new drawing.

To design use the "P" (plot) command. For example, after specifying the color, a "P 6, 8-10" would plot in the 6th column, 8th row; 10 units (each unit is 1/2 byte) would be output across the screen from left to right. "P 10,8:20" would plot a vertical bar down 20 units beginning with 10 (column), 8 (row). You can output a single unit by indicating its location – for example "P 20,31". Any line may be erased and the background color restored by typing "E" and the specified location – for example, "E 13,10-5".

When you complete the design, you can save it on cassette tape and/or output it to a printer.

With the Graphics program and a little imagination, you can use your Dazzler to plan landscaping, design needlework, lay out rooms and present sales graphs. Let this program unleash your creativity.

Typing a "D" disables the Dazzler but leaves the design intact in memory. The Dazzler slows down the CPU by about 15% and also uses the same bus as the CPU. Therefore, the Dazzler slows down the data transmission rate, increasing the possibility of errors. To avoid these errors, you should turn off the Dazzler when saving data.

If you want hard copy, type "Y" after the prompt. Be sure the printer is on and ready because the program immediately sends the design to the printer. The program automatically returns to the CRT after completing the output. The printout is based on the colors in each memory location. Each byte is divided into its two color units. The color codes at this time could not output a character to the printer so it is ADDed to 40Q. Each color now has a separate corresponding character based on its color code + 40Q. Although the hard copy is coded according to the colors on the design, each symbol can represent any color you choose. If you don't have a printer, you can place a plastic grid over the television screen and manually copy the design.

If you also want a tape, you can give it any three letter name and immediately save it. It can later be loaded into the display area by typing "L, (three letter name)" anytime after the Dazzler is initialized but before the "D" command. (The program loops back to the beginning after the "D" routine.)

All port numbers are specified at the beginning of the program listing and should be changed to correspond with your port numbers. "Last" indicates the last available memory address. "Graphics" is designed to work in a 2K area that has "377" as the lower order ending address for the display area. It was written in Assembly Language for the 8080 microprocessor chip.

With "Graphics", you can set up a Lemonade Needlework Design Service. Since custom-designed needlework is so expensive, you can design your own creations and market them.

Your printer provides the key to the design work – the backbone of every needlepoint kit. Designs in books can be modified to suit your tastes; the television provides a good indication of what the finished product will look like. Color combinations can be interchanged at will to provide a variety of effects.

The ease of designing with "Graphics" will surely bring out the latent creativity in all of us. □

Graphics Command Table

C Sets the color for the next routine. The color remains set until it is changed or erased.
* C,BL

F Fills the entire screen with the color previously set. This command is used for the background of the display and may be changed while drawing the design.
* C,G
* F

P Draws vertical or horizontal lines on the screen in the color previously set. It continues to draw in the same color until the color (C) is changed. A ":" after the starting point indicates a vertical line. A "-" indicates a horizontal line.
* C,O
* P 24,32:5
* P 8,9-15

E Erases any line or point on the screen and restores the background color. It is formated the same as the P command. After erasing an area, the color (C) must be reset.
* C,LI
* P 25, 18-8
* E 25, 18-8
* C,LI

N Clears the entire display area for a new design.
* N

L Loads a display from cassette tape into the display area. The display can then be viewed and/or edited.
*L,CHS

D Disables the Dazzler and exits program portion
* D

To store a display on tape:
SAVE ON TAPE? (Computer output)
* Y
* (Enter a three letter name, for example, CHS)

Program Listing

```
1       ;               GRAPHICS LANGUAGE PROGRAM
2       ;               FOR USE WITH CROMEMCO DAZZLER
3       ;               --- LINDA M. SCHREIBER ---
4       ;               APRIL 1978 VER.  2.7
5               ORG     104000Q
6       TERMS   EQU     20Q       ;STATUS PORT OF TERMINAL
7       TERMD   EQU     21Q       ;DATA PORT OF TERMINAL
8       PRNTRS  EQU     22Q       ;STATUS PORT OF PRINTER
9       PRNTRD  EQU     23Q       ;DATA PORT OF PRINTER
10      ACSTAT  EQU     6         ;STATUS PORT OF AUDIO CASETTE
11      ACDATA  EQU     7         ;DATA PORT OF AUDIO CASETTE
12      DAZD    EQU     16Q       ;ENABLE/DISABLE DAZZLER PORT
13      DAZF    EQU     17Q       ;FORMAT OF THE PICTURE PORT
14      LAST    EQU     117777Q ;LAST AVAILABLE MEMORY ADDRESS
15      TEMBUF: LXI     SP,TEMBUF         ;TEMPORARY STACK AREA
16      ;               MOD. 1 - OUTPUT FIRST MESSAGE
17      START:  LXI     H,CRLF    ;ADDRESS OF CARRIAGE RETURN & LINE FEED
18              LXI     D,MSG1    ;ADDRESS OF FIRST MESSAGE
19              PUSH    D
20              MVI     C,2       ;TWO OUTPUTS
21      OUT:    CALL    OUTMSG    ;OUTPUT LINE
22              DCR     C
23              JZ      MODE      ;NEXT MODULE
24              POP     H         ;GET NEXT LINE
25              JMP     OUT
26      ;               MOD. 2 - MODES
27      ;               RESOLUTION - NORMAL
28      MODE:   MVI     B,0       ;SET MODE FOR NORMAL RESOLUTION
29                                ;STORE IN B
30      ;               DISPLAY AREA - 512 BYTES OR 2K
31      AREA:   LXI     H,CRLF
32              LXI     D,MSG2    ;ADDRESS FOR NEXT MESSAGE
33              PUSH    D
34              MVI     C,2       ;TWO LINES OF OUTPUT
35      AROUT:  CALL    OUTMSG    ;OUTPUT ROUTINE
36              DCR     C
37              JZ      SIZE
38              POP     H         ;NEXT LINE
39              JMP     AROUT
40      SIZE:   CALL    PROMPT    ;GET MESSAGE
41              MVI     A,62Q     ;CHECK FOT A 2
42              CMP     M         ;IN FIRST MEMORY LOCATION
43              JZ      K2
```

Program Listing continued

```
44                  MVI     A,65Q    ;CHECK FOR A 5
45                  CMP     M
46                  JNZ     ERR1     ;NEITHER 2 NOR 5 IS AN ERROR
47                  MVI     C,2Q     ;SET FOR DISPLAY AREA
48                  MVI     A,32     ;WIDTH OF DISPLAY
49                  STA     WIDTH
50                  JMP     STPNTR   ;SET STACK POINTER ROUTINE
51      K2:         MVI     A,40Q    ;SET D5 FOR 2-K OF MEMORY
52                  ADD     B
53                  MOV     B,A      ;SAVE   FOR COLOR MODE
54                  MVI     C,10Q    ;SET FOR DISPLAY AREA
55                  MVI     A,64
56                  STA     WIDTH
57      STPNTR:     LXI     H,LAST   ;GET LAST BYTE OF MEMORY
58                  INX     H        ;OUT OF DISPLAY AREA
59                  SHLD    OSAVE    ;USE IT LATER
60                  DCX     H        ;BACK TO THE END OF DISPLAY AREA
61                  MOV     A,H
62                  SUB     C        ;DISPLAY AREA
63                  MOV     H,A      ;LAST BYTE BEFORE DISPLAY AREA
64                  SPHL             ;INITIALIZE STACK POINTER
65                  SHLD    HSAVE    ;SAVE FOR LATER USE
66      COLOR:      LXI     H,CRLF
67                  LXI     D,MSG3   ;THIRD OUTPUT
68                  PUSH    D
69                  MVI     C,2
70      CLROUT:     CALL    OUTMSG
71                  DCR     C
72                  JZ      CLRIN
73                  POP     H
74                  JMP     CLROUT
75      CLRIN:      CALL    PROMPT
76                  MVI     A,103Q   ;CHECK FOR 'C'
77                  CMP     M
78                  JZ      CLR      ;COLOR ROUTINE
79                  MVI     A,102Q   ;CHECK FOR 'B'
80                  CMP     M
81                  JZ      BAW      ;BLACK/WHITE ROUTINE
82                  CALL    ERROR1   ;BAD INPUT
83                  JMP     CLRIN    ;TRY AGAIN
84      CLR:        MVI     A,20Q    ;SET D4 FOR COLOR
85                  ADD     B        ;ADD TO CONTENTS OF B
86                  MOV     B,A      ;STORE DAZZLER INITIALIZATION
87      BAW:        LHLD    HSAVE    ;LAST BYTE BEFORE DISPLAY AREA
88                  INX     H        ;FIRST BYTE OF DISPLAY AREA
89                  SHLD    HSAVE    ;SAVE THE LOCATION FOR LATER USE
90                  MOV     A,H
91                  STA     BARSAV
92                  RAR
93                  ORI     200Q     ;TURN ON 7D TO INITIALIZE DAZZLER
94                  STA     DAZADR   ;STORE INITIALIZATION ADDRESS FOR FUTURE
95                  OUT     DAZD     ;OUTPUT TO DISABLE/ENABLE PORT
96                  MOV     A,B      ;MODE OF DAZZLER
97                  STA     DAZ
98                  OUT     DAZF     ;OUTPUT TO SET FORMAT OF PICTURE
99      ;                    MOD 3 - DIRECT COMMANDS FOR DESIGNING
100                 JMP     NEW
101     DESIGN:     CALL    PROMPT   ;ASK FOR INPUT
102                 MVI     A,103Q   ;'C' FOR COLOR
103                 CMP     M
104                 JZ      CLCD     ;GET COLOR
105                 MVI     A,120Q   ;IS IT A 'P'
106                 CMP     M
107                 JZ      PLOT
108                 MVI     A,105Q   ;IS IT AN 'E'
109                 CMP     M
110                 JZ      ERASE
111                 MVI     A,106Q   ;IS IT AN 'F'
112                 CMP     M
113                 JZ      FILL
114                 MVI     A,116Q   ;IS IT AN 'N'
115                 CMP     M
116                 JZ      NEW
117                 MVI     A,114Q   ;IS IT AN 'L'
118                 CMP     M
119                 JZ      LOAD
120                 MVI     A,104Q   ;IS IT A 'D'
121                 CMP     M
122                 JZ      DONE
123                 CALL    ERROR1   ;INPUT IS INVALID
```

```
124                 JMP     DESIGN  ;TRY AGAIN
125     CLCD:       INX     H       ;BUMP BUFFER POINTER
126                 MVI     A,54Q   ;CHECK FOR ','
127                 CMP     M
128                 JNZ     CLERR
129                 MVI     C,3     ;COUNT SPACES
130     SPOUT:      DCR     C
131                 JZ      CLERR   ;TOO MANY SPACES
132                 INX     H       ;NEXT CHARACTER
133                 MVI     A,40Q   ;SPACE
134                 CMP     M
135                 JZ      SPOUT   ;IGNORE ONE SPACE
136                 LXI     D,ORANGE        ;COLOR VALUE IN BINARY CODE
137                 MVI     A,117Q  ;'O'
138                 CMP     M
139                 JZ      SETB    ;IT'S ORANGE
140                 JC      MOR1    ;HIGHER VALUE THAN ORANGE
141                 LXI     D,GREEN ;ANOTHER COLOR VALUE
142                 MVI     A,107Q  ;'G'
143                 CMP     M
144                 JZ      SETB    ;IT'S GREEN
145                 JC      LIL     ;POSSIBLY AN 'L'
146                 MVI     A,102Q  ;'B'
147                 CMP     M
148                 JNZ     CLERR   ;NOT LISTED
149                 INX     H       ;BUMP TO CHARACTER AFTER 'B'
150                 DCX     D       ;MOVE TABLE POINTER
151                 DCX     D       ;TO 'BLUE'
152                 MVI     A,114Q  ;'L'
153                 CMP     M
154                 JZ      SETB    ;IT7S BLUE
155                 JC      BRITE   ;IT'S BR. BLUE
156                 DCX     D       ;POINT TO 'BLACK'
157                 DCR     A       ;'K'
158                 CMP     M
159                 JZ      SETB    ;IT'S BLACK
160                 DCX     D       ;NEXT COLOR CODE
161                 MVI     A,57Q   ;'/'
162                 CMP     M
163                 JNZ     CLERR   ;NOT LISTED
164                 JMP     SETB    ;IT'S BLUE/GREEN
165     BRITE:      INX     D       ;COLOR ON TABLE
166                 MVI     A,122Q  ;'R'
167                 CMP     M
168                 JZ      SETB    ;IT'S BR. BLUE
169                 JMP     CLERR
170     LIL:        INX     D       ;NEXT COLOR CODE
171                 MVI     A,114Q  ;'L'
172                 CMP     M
173                 JC      MAIZE
174                 JNZ     CLERR   ;NOT LISTED
175                 INX     H       ;NEXT CHARACTER AFTER 'L'
176                 MVI     A,111Q  ;'I'
177                 CMP     M
178                 JZ      SETB    ;IT'S LILAC
179                 INX     D       ;NEXT COLOR CODE
180                 MVI     A,107Q  ;'G'
181                 CMP     M
182                 JZ      SETB    ;IT'S LT. GREEN
183                 JMP     CLERR   ;NOT LISTED
184     MAIZE:      INX     D
185                 INX     D       ;BUMP TABLE POINTER
186                 INR     A       ;'M'
187                 CMP     M
188                 JZ      SETB
189                 JMP     CLERR
190     MOR1:       LXI     D,RED   ;TABLE POINTER
191                 MVI     A,122Q  ;'R'
192                 CMP     M
193                 JZ      SETB
194                 JC      TUR
195                 DCX     D       ;ONE PLACE LOWER
196                 MVI     A,120Q  ;'P'
197                 CMP     M
198                 JNZ     CLERR
199                 INX     H       ;NEXT LETTER
200                 MVI     A,125Q  ;'U'
201                 CMP     M
202                 JZ      SETB    ;IT'S PURPLE
203                 DCX     D
```

Program Listing continued

```
204             MVI     A,111Q  ;'I'
205             CMP     M
206             JZ      SETB    ;IT'S PINK
207             JMP     CLERR
208     TUR:    INX     D
209             MVI     A,124Q  ;'T'
210             CMP     M
211             JZ      SETB
212             INX     D
213             MVI     A,127Q  ;'W'
214             CMP     M
215             JNZ     CLERR
216     SETB:   XCHG
217             MOV     B,M
218             JMP     DESIGN  ;NEXT INSTRUCTION
219     NEW:    MVI     B,0     ;NO COLOR
220             MOV     A,B
221             STA     CSAVE   ;SAVE THE BKGD COLOR
222             LHLD    OSAVE   ;GET OUT OF DISPLAY BYTE
223             XCHG
224             LHLD    HSAVE   ;FIRST BYTE
225     NEBK:   MOV     A,H
226             CMP     D
227             JZ      DESIGN
228     MC:     MOV     M,B     ;CLEAR OUT LOCATION
229             MOV     A,M     ;IS IT THERE?
230             CMP     B
231             JNZ     MC
232             INX     H       ;NEXT LOCATION
233             JMP     NEBK
234     PLOT:   CALL    ROTB    ;ROUTINE FOR DETERMINING NEW COLOR
235             JZ      INERR
236     PL1:    STA     NEWCO
237             MVI     C,3
238     PLOUT:  DCR     C
239             JZ      CLERR
240             INX     H       ;NEXT CHARACTER
241             MVI     A,40Q   ;SPACE
242             CMP     M
243             JZ      PLOUT   ;IGNORE ONE SPACE
244             CALL    FINDCO  ;GET ONE SECTION AT A TIME
245             CALL    GETCH   ;ASCII TO BINARY
246             STA     STACO
247             MOV     C,A
248             LDA     WIDTH
249             DCR     A
250             CMP     C
251             JC      CLERR
252             CALL    FINDDA
253             CALL    GETCH
254             STA     STARO
255             MOV     C,A
256             LDA     WIDTH
257             DCR     A
258             CMP     C
259             JC      CLERR
260             LDA     CRTN
261             CPI     15Q     ;CHECK FOR CARRIAGE RETURN
262             JZ      DOT
263             CALL    FINDDA
264             CALL    GETCH
265             MOV     C,A
266             CALL    SETC
267     DEOUT:  MVI     D,0     ;SET FLAG FOR PLOT-LINE
268             CALL    STADR
269             DCR     C
270             JM      DESIGN  ;ONLY 1 UNIT WAS WANTED
271             INR     C       ;RESTORE C
272             LDA     UPORDO  ;GET CODE
273             CPI     72Q     ;':'
274             JZ      DOWN
275             DCR     D
276             JZ      LINE1
277             JMP     LINE
278     DOT:    MVI     C,1     ;ONE UNIT WANTED
279             JMP     DEOUT
280     STADR:  LDA     STARO
281             LHLD    HSAVE   ;GET FIRST BYTE OF DISPLAY
282             CPI     32      ;FIND THE QUADRANT
283             JNC     BOTDIS  ;IT'S THE BOTTOM OF THE DISPLAY
```

```
284             CPI     16
285             JNC     TOPBOT  ;BOTTOM HALF OF TOP OF DISPLAY
286     SETL:   RLC
287             RLC
288             RLC
289             RLC
290             ADD     L       ;SET L FOR THE ROW
291             MOV     L,A
292             JMP     SETCOL
293     TOPBOT: SUI     16      ;FIND ROW NUMBER
294             INR     H
295             JMP     SETL
296     BOTDIS: CPI     48      ;WHICH HALF OF BOTTOM
297             JNC     BOTHLF
298             SUI     32
299     SETH:   INR     H
300             INR     H
301             INR     H
302             INR     H       ;POINT H TO BOTTOM HALF
303             JMP     SETL
304     BOTHLF: SUI     48
305             INR     H
306             JMP     SETH
307     SETCOL: LDA     STACO   ;THIS ROUTINE SETS L FOR THE COLUMN
308             CPI     32      ;WHICH SIDE?
309             JNC     RTHLF
310             PUSH    PSW
311             LDA     BARSAV
312             INR     A
313             INR     A
314             STA     QUADSV
315             POP     PSW
316     SETLL:  CMC             ;RESET CARRY FLAG
317             RAR             ;DIVIDE BY 2
318             JNC     ONEBYT
319             ADD     L
320             MOV     L,A     ;SET LOWER 4 BITS
321             MOV     A,B     ;GET NEW COLOR
322             ANI     360Q    ;MASK HALF BYTE
323             MOV     B,A     ;STORE COLOR
324             MOV     A,M     ;BKGD COLOR
325             ANI     17Q     ;MASK UPPER 4 BITS
326             ADD     B       ;NEW COLOR IS 1/2 BKGD
327             MOV     M,A     ;DISPLAY COLOR
328             DCR     C       ;FILLED ONE UNIT
329             MOV     A,L     ;CHECK LOCATION OF UNIT
330             ANI     17Q
331             CPI     17Q
332             RNZ
333             MVI     D,1     ;SET FLAG FOR PLOTTING LINE
334             RET
335     ONEBYT: ADD     L
336             MOV     L,A
337             DCX     H
338             RET
339             JMP     MON
340     FILL:   CALL    ROTB
341             JZ      INERR
342             STA     NEWCO
343             LHLD    OSAVE   ;END ADDRESS
344             XCHG            ;STORE IN D
345             LHLD    HSAVE   ;BEGINNING ADDRESS
346     FICLR:  LDA     CSAVE   ;OLD BKGD COLOR
347             MOV     C,A     ;STORE IN C
348             MOV     A,M
349             CMP     C       ;IS IT A DIFFERENT COLOR
350             JNZ     RTSIDE  ;IT'S NOT THE BKGD
351     REPL:   MOV     M,B     ;NEW BKGD COLOR IN PLACE
352             MOV     A,M     ;CHECK TO BE SURE
353             CMP     B
354             JNZ     REPL    ;IT ISN'T THERE
355     NEXT:   INX     H       ;NEXT DISPLAY LOCATION
356             MOV     A,H
357             CMP     D       ;ARE WE DONE?
358             JNZ     FICLR   ;PUT IN MORE BKGD. COLOR
359             MOV     A,B     ;SAVE NEW BKGD COLOR
360             STA     CSAVE
361             MVI     B,0     ;CLEAR REG.
362             JMP     DESIGN  ;NEW INSTRUCTION
363     RTSIDE: MOV     A,C
```

Program Listing continued

```
364                ANI     17Q      ;CHECK THE LOWER NIBBLE
365                MOV     C,A
366                MOV     A,M
367                ANI     17Q
368                CMP     C
369                JNZ     LFTSID
370                MOV     A,B      ;ADJUST NEW COLOR
371                ANI     17Q
372                MOV     B,A
373                MOV     A,M      ;ADJUST LOCATION
374                ANI     360Q
375                ADD     B
376                MOV     M,A      ;OUTPUT NEW BKGD
377                LDA     NEWCO    ;RESTORE B TO NEW COLOR
378                MOV     B,A
379                JMP     NEXT
380     LFTSID:    LDA     CSAVE    ;CHECK UPPER NIBBLE
381                ANI     360Q
382                MOV     C,A
383                MOV     A,M      ;CHECK UPPER NIBBLE IN LOCATION
384                ANI     360Q
385                CMP     C
386                JNZ     NEXT
387                MOV     A,B
388                ANI     360Q
389                MOV     B,A
390                MOV     A,M
391                ANI     17Q
392                ADD     B
393                MOV     M,A
394                LDA     NEWCO
395                MOV     B,A
396                JMP     NEXT
397     ERASE:     LDA     CSAVE    ;RESTORE BACKGROUND COLOR
398                MOV     B,A      ;TO ERASE PRESENT COLOR
399                JMP     PL1
400     DONE:      LXI     H,CRLF
401                LXI     D,MSDON  ;MESSAGE TO END PROGRAM
402                PUSH    D
403                MVI     C,2
404     OTCL:      CALL    OUTMSG
405                DCR     C
406                JZ      DAZOFF
407                POP     H
408                JMP     OTCL
409     DAZOFF:    XRA     A        ;TURN OFF DAZZLER
410                OUT     16Q
411                CALL    PROMPT
412                MOV     A,M      ;GET ANSWER
413                CPI     131Q     ;IS IT YES?
414                CZ      HRDCPY
415     SVDSGN:    LXI     H,CRLF
416                LXI     D,MSSAVE         ;ASK IF DESIGN IS TO BE SAVED
417                PUSH    D
418                MVI     C,2
419     SVOT:      CALL    OUTMSG
420                DCR     C
421                JZ      SVROUT
422                POP     H
423                JMP     SVOT
424     SVROUT:    CALL    PROMPT
425                MOV     A,M      ;GET ANSWER
426                CPI     131Q     ;IS IT YES?
427                CZ      TAPE
428                JMP     MODE     ;REPEAT PROGRAM
429     TAPE:      LXI     H,CRLF
430                LXI     D,MSTAPE
431                PUSH    D
432                MVI     C,2
433     TPOUT:     CALL    OUTMSG
434                DCR     C
435                JZ      TOTAPE
436                POP     H
437                JMP     TPOUT
438     TOTAPE:    CALL    PROMPT
439                MVI     C,3
440     NAME:      MOV     A,M      ;OUTPUT NAME OF DESIGN
441                CALL    ACOUT
442                INX     H        ;GET NEXT LETTER
443                DCR     C
```

```
444             JNZ     NAME
445             LHLD    OSAVE
446             XCHG
447             LHLD    HSAVE   ;FIRST BYTE OF DISPLAY
448     OUTDES: MOV     A,M     ;OUTPUT DESIGN
449             CALL    ACOUT
450             INX     H
451             MOV     A,H     ;CHECK FOR END OF DISPLAY
452             CMP     D
453             JNZ     OUTDES
454             RET
455     HRDCPY: MVI     A,3     ;INITIALIZE PRINTER PORT
456             OUT     22Q
457             MVI     A,21Q
458             OUT     PRNTRS
459             MVI     C,0     ;SET COUNTER FOR LINES
460             LHLD    OSAVE   ;END OF DISPLAY
461             XCHG            ;STORE IT IN D
462             LHLD    HSAVE   ;FIRST BYTE OF DISPLAY
463     OUTDIS: CALL    CHROUT
464             MOV     A,L     ;CHECK F R END OF QUADRANT
465             ANI     17Q
466             CPI     17Q
467             JZ      NXTQUD
468             INX     H       ;BUMP DISPLAY POINTER
469             JMP     OUTDIS
470     SCDHLF: CALL    CHROUT
471             MOV     A,L     ;CHECK FOR END OF LINE
472             ANI     17Q
473             CPI     17Q
474             JZ      ENDLNE
475             INX     H
476             JMP     SCDHLF
477     NXTQUD: INR     H       ;GET POINTER INTO SECOND HALF OF DISPLAY
478             INR     H
479             MOV     A,L     ;SET LOWER NIBBLE TO 0
480             ANI     360Q
481             MOV     L,A
482             JMP     SCDHLF
483     ENDLNE: INR     C       ;COUNT LINES OUTPUTTED
484             MVI     A,15Q   ;CARRIAGE RETURN
485             CALL    DSNOUT
486             MVI     A,12Q   ;LINE FEED
487             CALL    DSNOUT
488             MVI     A,32    ;NUMBER OF LINES MAX.
489             CMP     C
490             JZ      QUD3
491             DCR     H       ;WRAP AROUND SCREEN
492             DCR     H
493             INX     H       ;NEXT LINE IN DISPLAY
494             JMP     OUTDIS
495     QUD3:   MVI     C,0     ;RESET COUNTER
496             INX     H
497             MOV     A,H     ;CHECK FOR END OF DISPLAY
498             CMP     D
499             RZ
500             JMP     OUTDIS
501     CHROUT: MOV     A,M     ;GET BYTE OF DISPLAY
502             MOV     B,A     ;STORE ENTIRE BYTE
503             ANI     17Q     ;LOWER NIBBLE IS OUTPUT FIRST
504             ADI     40Q     ;MAKE IT A CHARACTER
505             CALL    DSNOUT
506             MOV     A,B     ;GET BACK BYTE
507             ANI     360Q    ;NOW OUTPUT UPPER NIBBLE
508             RRC             ;SHIFT INTO POSITION
509             RRC
510             RRC
511             RRC
512             ADI     40Q     ;MAKE IT A CHARACTER
513             CALL    DSNOUT
514             RET
515     DSNOUT: PUSH    PSW     ;SAVE CHARACTER
516     HSTA:   IN      PRNTRS  ;GET STATUS OF PRINTER
517             ANI     2
518             JZ      HSTA
519             POP     PSW
520             OUT     PRNTRD
521             RET
522     ERR1:   CALL    ERROR1  ;ERROR MESSAGE
523             JMP     SIZE    ;TRY AGAIN
```

Program Listing continued

```
524     CLERR:  CALL    ERROR1
525             JMP     DESIGN  ;TRY AGAIN
526     OUTMSG: MOV     A,M     ;GET CHARACTER
527             INX     H       ;BUMP POINTER
528             ORA     A       ;CHECK FOR FLAG
529             RZ
530             CALL    TOUT    ;OUTPUT CHARACTER
531             JMP     OUTMSG
532     INMSG:  CALL    TIN     ;GET THE INPUT
533             CPI     177Q    ;IS IT A RUBOUT
534             JZ      ROUT    ;RUBOUT ROUTINE
535             CPI     15Q     ;CHECK FOR END OF INPUT
536             MOV     M,A     ;PUT CHARACTER IN BUFFER
537             RZ
538             INX     H       ;BUMP BUFFER
539             DCR     D
540             JZ      BERR
541             JNZ     INMSG   ;REPEAT FOR NEXT CHARACTER
542     TIN:    IN      TERMS   ;GET STATUS
543             ANI     1
544             JZ      TIN     ;NOT READY
545             IN      TERMD   ;INPUT CHARACTER
546             ANI     177Q    ;STRIP PARITY BIT
547     TOUT:   PUSH    PSW     ;SAVE CHARACTER
548     STAT:   IN      TERMS   ;GET STATUS
549             ANI     2
550             JZ      STAT    ;NOT READY
551             POP     PSW     ;GET CHARACTER
552             OUT     TERMD   ;OUTPUT CHARACTER
553             RET
554     ROUT:   MVI     A,137Q  ;PUT _ IN ACCUMULATOR
555             CALL    TOUT    ;OUTPUT IT TO TERMINAL
556             INR     D
557             MOV     A,D
558             CPI     73
559             JNC     SETD
560             DCX     H       ;SET POINTER BACK ONE
561             JMP     INMSG   ;GET MORE INPUT
562     SETD:   MVI     D,72
563             JMP     INMSG
564     PROMPT: LXI     H,PT    ;PROMPT
565             CALL    OUTMSG  ;OUTPUT *
566             LXI     H,BUF   ;BUFFER INPUT AREA
567             PUSH    H       ;SAVE FOR RESET
568             MVI     D,72    ;BUFFER SPACES
569             CALL    INMSG   ;GET INPUT
570             POP     H       ;RESET BUFFER POINTER TO BEGINNING
571             CMP     M
572             JZ      PROMPT  ;NO INPUT
573             RET
574     FINDCO: PUSH    H       ;SAVE CHARACTER OF THIS SERIES
575             MVI     C,0     ;CLEAR COUNTER
576     COMMA:  MVI     A,54Q   ;','
577             CMP     M
578             JZ      RTRN
579             INR     C       ;COUNT CHARACTER
580             INX     H       ;NEXT CHARACTER
581             MVI     A,2
582             CMP     C
583             JC      CLERR
584             JMP     COMMA
585     RTRN1:  STA     UPORDO  ;SAVE CODE
586     RTRN:   INX     H       ;NEXT CHARACTER AFTER COMMA
587             STA     CRTN    ;SAVu CODE FOR LINE OR BAR OR COMMA
588             POP     D       ;PUT SAVED LOCATION IN D
589             RET
590     FINDDA: PUSH    H       ;SAVE BEGINNING OF THIS SERIES
591             MVI     C,0     ;CLEAR REGISTER
592     DASH:   MVI     A,15Q
593             CMP     M
594             JZ      RTRN
595             MVI     A,72Q   ;':'
596             CMP     M
597             JZ      RTRN1
598             MVI     A,55Q   ;'-'
599             CMP     M
600             JZ      RTRN1
601             INR     C
602             INX     H
603             MVI     A,2
```

```
604                CMP     C
605                JC      CLERR
606                JMP     DASH
607     GETCH:     XCHG                ;SWAP ADDRESSES IN BUFFER AREA
608                PUSH    D           ;SAVE LAST CHARACTER LOCATION
609                MVI     E,0         ;CLEAR E
610     GETAG:     MOV     A,M         ;DIGIT TO BE ADJUSTED
611                CPI     57Q         ;AT LEAST A ZERO
612                JC      CLERR
613                ANI     317Q        ;STRIP 60Q
614                CPI     12Q         ;'9' IS THE LIMIT
615                JNC     CLERR
616                DCR     C
617                JZ      LADIG       ;LAST DIGIT OF THIS SERIES
618                RLC                 ;MULTIPLY X2
619                MOV     E,A
620                ADD     A           ;X4
621                ADD     A           ;X8
622                ADD     E           ;NOW X10
623                MOV     E,A         ;SAVE NUMBER X10
624                INX     H
625                JMP     GETAG
626     LADIG:     ADD     E           ;ADD ACCUMULATOR TO E FOR BINARY NUMBER
627                POP     H           ;PUT IN NEXT CHARACTER LOCATION
628                RET
629     ROTB:      MOV     A,B         ;GET COLOR
630                RRC
631                RRC
632                RRC
633                RRC
634                ORA     B           ;BOTH NIBBLES HAVE SAME CODE
635                MOV     B,A         ;SAVE COLOR
636                RET
637     SETC:      LDA     UPORDO      ;GET DIRECTION
638                MOV     D,A
639                CPI     72Q         ;':'
640                JZ      CHECKCO
641                LDA     STACO
642     PARMT:     MOV     D,A
643                LDA     WIDTH       ;MOST UNITS IN A ROW
644                SUB     D           ;UNITS TO THE RIGHT OF STARTING POINT
645                CMP     C           ;DON'T TRY TO FILL MORE THAN THERE ARE
646                JC      CLERR
647                RET
648     CHECKCO:           LDA     STARO
649                JMP     PARMT
650     LINE:      INX     H           ;NEXT LOCATION
651                LDA     NEWCO       ;GET COMPLETE COLOR
652                MOV     B,A
653                DCR     C           ;TEST FOR END OF LINE
654                DCR     C
655                JM      HALFBY
656                MOV     M,B         ;OUTPUT COLOR
657                JZ      DESIGN
658     LINE1:     MOV     A,L         ;CHECK LOCATION ON DISPLAY
659                ANI     17Q
660                CPI     17Q         ;DON'T START A NEW LINE
661                JNZ     LINE
662                INR     H           ;NEXT QUADRANT IN ROW
663                INR     H
664                MOV     A,L
665                SUI     20Q         ;GET IT IN THE SAME ROW
666                CPI     377Q        ;END OF QUANDRANT
667                MOV     L,A
668                JNZ     LINE
669                DCR     H
670                JMP     LINE
671     BY:        INX     H
672     HALFBY:    MOV     A,B         ;GET COLOR
673                ANI     17Q
674                MOV     B,A         ;SAVE HALF THE COLOR
675                MOV     A,M         ;GET COLOR FROM DISPLAY
676                ANI     360Q        ;HALF OF COLOR
677                ADD     B           ;PUT HALVES TOGETHER
678                MOV     M,A         ;DISPLAY COLOR
679                INR     C
680                JZ      DESIGN
681                DCR     C
682                DCR     C
683                JZ      DESIGN
```

Program Listing continued

```
684                JMP     DOWN2
685     RTHLF:     INR     H
686                INR     H
687                SUI     32
688                STC
689                PUSH    PSW
690                LDA     BARSAV
691                INR     A
692                INR     A
693                INR     A
694                INR     A
695                STA     QUADSV
696                POP     PSW
697                JMP     SETLL
698     DOWN:      LDA     STACO   ;DETERMINE WHICH SIDE OF BYTE
699                RAR             ;COLOR WILL BE ON
700                JNC     BY
701     DOWN1:     CALL    QUAD    ;CHECK FOR END OF QUADRANT
702                MOV     A,L
703                ADI     20Q     ;NEXT ROW SAME COLUMN
704                MOV     L,A
705                MOV     A,M     ;SEE WHAT'S DISPLAYED
706                ANI     17Q     ;MASK HALF
707                ADD     B       ;GET RIGHT COLOR COMB.
708                MOV     M,A
709                DCR     C       ;COUNT DOWN
710                JZ      DESIGN
711                JMP     DOWN1
712     DOWN2:     CALL    QUAD    ;CHECK FOR END OF QUADRANT
713                MOV     A,L
714                ADI     20Q
715                MOV     L,A
716                MOV     A,M
717                ANI     360Q
718                ADD     B
719                MOV     M,A
720                DCR     C
721                JZ      DESIGN
722                JMP     DOWN2
723     QUAD:      MOV     A,L
724                ANI     360Q    ;UPPER 4 BITS ARE THE ROW
725                CPI     360Q
726                RNZ
727                INR     H
728                LDA     QUADSV
729                CMP     H
730                RNZ
731                INR     H
732                INR     H
733                RET
734     LOAD:      INX     H       ;BUMP BUFFER POINTER
735                MVI     A,54Q   ;','
736                CMP     M
737                JNZ     CLERR
738                XRA     A       ;TURN OFF DAZZLER WHEN LOADING TAPE
739                OUT     DAZD
740                LHLD    OSAVE
741                XCHG
742     INIT:      MVI     C,3     ;NUMBER OF LETTERS IN NAME
743                LXI     H,BUF2
744     GET:       CALL    ACIN
745                CMP     M
746                JNZ     INIT
747                INX     H
748                DCR     C
749                JNZ     GET
750                LHLD    HSAVE   ;BEG. OF DISPLAY AREA
751     GET1:      CALL    ACIN
752                MOV     M,A     ;STORE BYTE IN MEMORY
753                INX     H
754                MOV     A,H
755                CMP     D       ;CHECK FOR END OF MEMORY
756                JNZ     GET1
757                LDA     DAZADR
758                OUT     DAZD
759                LDA     DAZ
760                OUT     DAZF
761                JMP     DESIGN
762     ACIN:      IN      ACSTAT  ;STATUS PORT OF AC
763                RAR             ;TEST IF READY
```

```
764             JC      ACIN    ;LOOP TILL READY
765             IN      ACDATA  ;GET DATA
766             RET
767     ACOUT:  PUSH    A
768     STAC:   IN      ACSTAT  ;STATUS PORT OF AC
769             RAL             ;CHECK STATUS
770             JC      STAC
771             POP     A
772             OUT     ACDATA
773             RET
774     ERROR1: LXI     H,CRLF
775             LXI     D,ERMSG1
776             PUSH    D
777             MVI     C,2
778     EROUT:  CALL    OUTMSG
779             DCR     C
780             RZ              ;ERROR MESS. OUTPUTTED
781             POP     H       ;MESSAGE
782             JMP     EROUT
783     INERR:  LXI     H,CRLF
784             LXI     D,ERMSG2
785             PUSH    D
786             MVI     C,2
787     INE:    CALL    OUTMSG
788             DCR     C
789             JZ      DESIGN
790             POP     H
791             JMP     INE
792     BERR:   LXI     H,CRLF
793             LXI     D,ERMSG3
794             PUSH    D
795             MVI     C,2
796     BOUT:   CALL    OUTMSG
797             DCR     C
798             JZ      PROMPT
799             POP     H
800             JMP     BOUT
801     HSAVE:  DS      2       ;BUFFER FOR H&L
802     OSAVE:  DS      2       ;BUFFER FOR OUT OF DISPLAY ADDRESS
803     CSAVE:  DS      1       ;BUFFER FOR BACKGROUND COLOR
804     STACO:  DS      1       ;STARTING COLUMN
805     STARO:  DS      1       ;STARTING ROW
806     DAZ:    DS      1       ;DAZZLER FORMAT
807     DAZADR: DS      1       ;DAZZLER ADDRESS
808     WIDTH:  DS      1       ;UNITS IN WIDTH OF DISPLAY
809     UPORDO: DS      1       ;CODE FOR BAR OR LINE
810     CRTN:   DS      1       ;CODE FOR CARRIAGE RETURN
811     BARSAV: DS      1       ;CODE FOR KEEPING BARS STRAIGHT
812     QUADSV: DS      1       ;QUADRANT ADDRESS NOT TO BE USED
813     NEWCO:  DS      1       ;NEW COLOR TO BE DISPLAYED
814     BUF:    DS      2       ;START OF BUFFER AREA
815     BUF2:   DS      70      ;BUFFER INPUT AREA
816     PT:     DB      "*  "   ;PROMPT
817             DB      0
818     ERMSG1: DB      "INPUT ERROR"
819             DB      15Q
820             DB      12Q
821             DB      0
822     ERMSG2: DB      "NO COLOR WAS GIVEN"
823             DB      15Q
824             DB      12Q
825             DB      0
826     ERMSG3: DB      "BUFFER OVERFLOW"
827             DB      15Q
828             DB      12Q
829             DB      0
830     MSG1:   DB      "GRAPHICS IS READY. FIRST SET THE AREA"
831             DB      " AND MODE FOR COLOR"
832             DB      15Q
833             DB      12Q
834             DB      "OR BLACK AND WHITE TO INITIALIZE THE DAZZLER."
835             DB      15Q
836             DB      12Q
837             DB      0       ;FLAG FOR END OF MESSAGE
838     MSG2:   DB      "INPUT AREA TO BE USED (512 OR 2K)"
839             DB      15Q
840             DB      12Q
841             DB      0
842     MSG3:   DB      "DO YOU WANT THE COLOR OR BLACK AND"
843             DB      " WHITE MODE?"
```

Program Listing continued

```
844                 DB      15Q
845                 DB      12Q
846                 DB      0
847     MSDON:      DB      "DO YOU WANT A HARD COPY (Y-N)"
848                 DB      15Q
849                 DB      12Q
850                 DB      0
851     MSSAVE:     DB      "SAVE ON TAPE?"
852                 DB      15Q
853                 DB      12Q
854                 DB      0
855     MSTAPE:     DB      "ENTER NAME OF DESIGN (3 LETTERS)"
856                 DB      15Q
857                 DB      12Q
858                 DB      0
859     CRLF:       DB      15Q         ;CARRIAGE RETURN
860                 DB      12Q         ;LINE FEED
861                 DB      0           ;FLAG
862     CLRTBL:     DB      6Q          ;B/GREEN
863                 DB      10Q         ;BLACK
864                 DB      4Q          ;BLUE
865                 DB      14Q         ;BR.BLUE
866     GREEN:      DB      2Q          ;GREEN
867                 DB      5Q          ;LILAC
868                 DB      12Q         ;LT.GREEN
869                 DB      13Q         ;MAIZE
870     ORANGE:     DB      3Q          ;ORANGE
871                 DB      11Q         ;PINK
872                 DB      15Q         ;PURPLE
873     RED:        DB      1Q          ;RED
874                 DB      16Q         ;TURQUOISE
875                 DB      17Q         ;WHITE
876                 END     DRW
```

Symbol Table

```
TERMS 000020        NEW 104620          DOWN 106424         DSNOUT 105713
TERMD 000021        DESIGN 104251       LINE1 106323        QUD3 105654
PRNTRS 000022       CLCD 104334         LINE 106305         HSTA 105714
PRNTRD 000023       PLOT 104654         BOTDIS 105065       TOUT 106014
ACSTAT 000006       ERASE 105342        TOPBOT 105057       INMSG 105755
ACDATA 000007       FILL 105174         SETL 105046         TIN 106001
DAZD 000016         LOAD 106520         SETCOL 105111       ROUT 106030
DAZF 000017         DONE 105351         BOTHLF 105103       BERR 106703
LAST 117777         CLERR 105735        SETH 105074         STAT 106015
$ 107612            SPOUT 104345        RTHLF 106400        SETD 106050
TEMBUF 104000       ORANGE 107604       QUADSV 106744       PT 107056
START 104003        SETB 104613         SETLL 105133        BUF 106746
CRLF 107571         MOR1 104531         ONEBYT 105165       COMMA 106105
MSG1 107147         GREEN 107600        FICLR 105214        RTRN 106131
OUT 104014          LIL 104464          RTSIDE 105252       RTRN1 106126
OUTMSG 105743       BRITE 104452        REPL 105225         DASH 106142
MODE 104027         MAIZE 104517        NEXT 105233         GETAG 106203
AREA 104031         RED 107607          LFTSID 105305       LADIG 106236
MSG2 107321         TUR 104575          MSDON 107446        CHECKCO 106277
AROUT 104042        CSAVE 106733        OTCL 105362         PARMT 106265
SIZE 104055         NEBK 104635         DAZOFF 105375       HALFBY 106353
PROMPT 106055       MC 104642           HRDCPY 105535       BY 106352
K2 104106           ROTB 106241         SVDSGN 105411       DOWN2 106456
ERR1 105727         INERR 106657        MSSAVE 107506       DOWN1 106433
WIDTH 106740        PL1 104662          SVOT 105422         QUAD 106501
STPNTR 104121       NEWCO 106745        SVROUT 105435       INIT 106536
OSAVE 106731        PLOUT 104667        TAPE 105451         BUF2 106750
HSAVE 106727        FINDCO 106102       MSTAPE 107526       GET 106543
COLOR 104140        GETCH 106177        TPOUT 105462        ACIN 106611
MSG3 107365         STACO 106734        TOTAPE 105475       GET1 106562
CLROUT 104151       FINDDA 106137       NAME 105502         STAC 106623
CLRIN 104164        STARO 106735        ACOUT 106622        ERMSG1 107062
CLR 104211          CRTN 106742         OUTDES 105522       EROUT 106646
BAW 104215          DOT 105021          OUTDIS 105556       ERMSG2 107100
ERROR1 106635       SETC 106251         CHROUT 105665       INE 106670
BARSAV 106743       DEOUT 104770        NXTQUD 105614       ERMSG3 107125
DAZADR 106737       STADR 105026        SCDHLF 105575       BOUT 106714
DAZ 106736          UPORDO 106741       ENDLNE 105625       CLRTBL 107574
```

Tooling Around with your Micro

BY CHIP A. TYETI

Whether you're a hobbyist, a businessman, an electronics engineer, a student or a housewife interested in computer technology, you'll find a collection of tools for both software and hardware a big boon to your operations. We've selected a few of the most interesting products to assist you in planning and implementing changes in your microcomputer system. The list of programming aids, hardware tools and assorted gadgets (vs. gimmicks – which seem to be less than authentic) is expanding along with the personal computing industry. Some companies with ingenious, inexpensive and often very practical products appear and disappear with incredible swiftness. A sharp eye for helpful devices lets you catch some gems before they fade into oblivion.

We'll discuss some of these tools, gadgets and devices from the software, then the hardware point of view. Our charts break the specifications of each item into easy-to-use information. Note the accompanying photographs, and use the circle numbers on the reader service card to get further information on any of these products.

Software Tools

Alpha Supply Company, Northridge, CA, offers a new coding form specifically designed for microcomputer programmers. This form provides space for writing in symbolic (mnemonics) with provision for on-page conversion to hex or octal for machine entry. This feature makes the form ideal for hand assembly of programs by programmers and development engineers. Software specialists will also find the form useful as a debugging tool for generating and documenting patches for any CPU.

Alpha Supply has other encoding forms for symbolic, FORTRAN, COBOL, BASIC and screen layout. These forms are printed on 8¼" x 11" bond paper, using nonreproducing blue ink, with 50 sheets to the pad. When you're preparing your program for entry into your system, nothing can make the job easier and flow more logically than laying out details in sequence on a sheet of paper – and this paper is specifically designed for this purpose.

Eldon Berg Publications, Aloha, OR, spent many long arduous hours compiling and editing the *Periodical Guide for Computerists*, a list of articles from the most popular magazines in the microcomputer industry. This two-volume guide, selling for $5 per volume, is available for 1975-76 and for 1977. The proliferation of reference articles has become overwhelming in recent months, and you'll appreciate this handy, efficient "tool" for weeding through some of the literature.

Fickled Thinking Aids, Orange, CA, certainly conceived a spunky name for their enterprise. They market some effective devices that will curb the fickled nature of flowcharts, diagrams, layouts and analyses. Plansheets, worksheets, starter kits, symbol pads, tapes and accessories comprise their offerings to date.

The plansheets and worksheets, along with the overlay sheets, are heavy quality paper or clear plastic that creates an electrostatic surface for symbol adhesion. Starter kits cost $12.50 each and offer an array of sheet material, symbol pads, tapes and accessories such as pens, erasers and a quality padded vinyl folder that doubles as a lap desk for on-the-go applications.

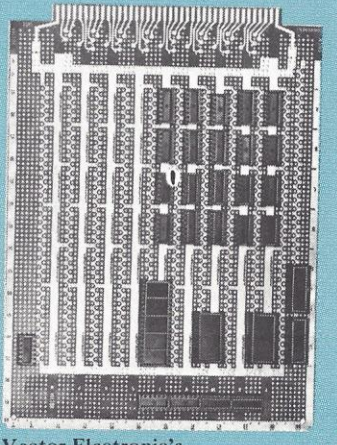
Hardware Tools

Continental Specialties Corporation, New Haven, CT, manufactures an excellent array of testing devices ranging from logic probes to DIP clip logic testers to breadboarding supplies to miscellaneous prototyping materials and tools. Their Logic Monitor (the DIP clip device), the LM-1, is an ideal tool for determining the validity of the ICs on-board.

Recently Continental Specialties cut the prices on seventeen items in their catalog. Check with your local computer retailer for new prices – they may just inspire you to become an electronics hardware genius.

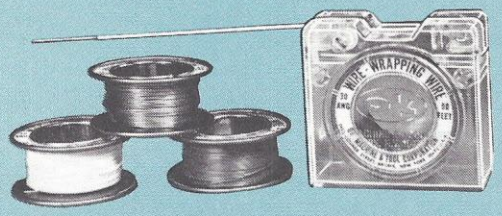
E & L Instruments, Derby, CT, lists an extensive collection of microcomputer development tools. MMD-1/MI Memory/Interface aids software development on the MMD-1 microcomputer system. It provides basic facilities needed to store and manipulate large blocks of digital data with minimum operator intervention. Adaptor cards, the buffered memory

Vaco's Original Super Tool Case 70260

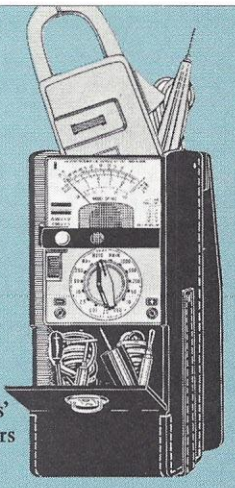


Vector Electronic's Plugbord 4350

Information Controls' LP-220 Series Light Pen



OK Machine & Tool's WD Series Wire Dispenser



Sperry Instruments' Twin-Pak for Meters

Continental Specialties' Design Mate 1

expansion card, outboard function circuits and data transmission outboards comprise the lion's share of other products offered by E & L Instruments.

Outboards are frequently-used circuits permanently assembled as modules that you can quickly install in the solderless breadboarding socket of the MMD-1 Mini-Micro Designer. These standardized designs simplify interfacing and minimize time required to implement special display, input/output or control circuits. Power is picked up directly from prewired buses in the breadboarding socket.

Model WK-5 wire wrapping kit is the epitome of all that is wire wrapping. Produced by OK Machine and Tool Corporation, Bronx, NY, the kit includes all the tools and parts you need for prototype and hobby applications, conveniently packaged in a handy, durable plastic carrying case. Inside the case you'll find a battery-operated wire wrapping tool, a universal PC board, an edge connector with wire-wrapping terminals, a set of PC card guides and brackets and much more – certainly worth the $74.95 price for any breadboarding enthusiast or electronics engineer.

With an eye to the future, you may wish to investigate Sharp's thin film electroluminescent TV. This black and white set, weighing just over eight pounds, features a six-inch diagonal screen. A matrix-type thin film electroluminescence (EL) panel developed by Sharp Corporation of Osaka, Japan, replaces the conventional picture tube. The super-thin flat display utilizes AC power to transmit pulses which alternatingly polarize and depolarize electrodes in the screen.

High pressure diffusion self-alignment circuitry combines with advanced semi-conductor technology to create the DSA MOS IC that handles signal processing and switching in the EL television set. Don't rush out just yet, because it will be a while before we can buy these TVs in the United States.

Chemtronics, Inc., Hauppauge, NY, sells a self-contained portable compressed air system that provides controlled removal of dust, lint, oxide particles, etc. without depositing harmful contaminants. Applications include use on mechanical and electrical miniature assemblies, audio components, computer tapes and heads, clean room areas, timepieces, business machines, camera lenses and other optics plus film, negatives and slides. This spray is particularly well suited for your micro and other delicate electronics because it contains pure, moisture-free, non-flammable and non-toxic filtered gas. A fifteen ounce can sells for about $2.50.

Several manufacturers offer a variety of aerosol cans filled with everything from silicon to freon. In several instances, my can of silicon spray has more than paid for itself. One spritz from the can gives excellent protection from moisture and other contaminants. Some products combine the benefits of silicon spray with a rust remover providing an excellent product for corroded, rusted equipment. The first spurt loosens the rust; the second cleans the area and coats it with silicon for future protection. GE makes one type which you'll find in most discount department stores.

The Devoke Company, Palo Alto, CA, recently introduced a solution to CRT work station clutter – a CRT tray formed of crystal-clear acrylic. This tray fits on top of CRT units to keep in-use documents stacked neatly within easy reach and sells for $11.50. The tray measures 16"w x 12" d x 2½" h with a handy thumb notch in the front, allowing easy access to the contents.

Periphicon Type 511 Optical Image Digitizer lets your computer perceive events and objects in the real world. A 32 x 32 element picture is easily accepted by almost any computer system. A fast (f1.9/13mm) lens, focusing from 0.2 meters to infinity, allows the Type 511 to solve problems in such fields as robotics and process control. Add this to your micro and you'll have all the makin's of Big Brother from Orwell's *1984*.

Not too long ago someone developed a little gadget that should have been marketed long ago: a two-lead PCB-mount LED socket. I recently finished building one of those clocks with about a hundred LEDs on the face and on the pendulum. Sockets would have made a much more practical printed circuit board with far less hassle in changing defective LEDs. Contacts on these sockets have 0.100" mounting centers and are tin-plated phosphor bronze with a special anti-wicking configuration to prevent solder or flux creepage. These new UNI-PAC-2LED sockets are available nationwide at Methode Industrial Distributors, or from their home office in Rolling Meadows, IL.

Midguard Electronics, Newton, MA, offers their UMB, Universal Printed Board. This board is an elegant and practical solution to many breadboarding and production problems. Its unique two-sided interlacing foil pattern incorporates four independent power planes, each one bussed to all 264 pad positions. This design allows you to use both analog and digital components on one board. Two aspects of the UMB make it especially suitable for prototyping and evaluating microprocessor or interface circuits. First, the grid of 792 holes available for components is aligned on 0.100" centers in both the x and y axes. Second, none of the component pads are tied to any of the power planes; power planes are bussed beside every pad position and require only short jumper wires to make connections. The price for 1 to 6 pieces is $17.15 each – a reasonable price for such a quality PCB.

Vector Electronic Company, Sylmar, CA, has a newly developed wrapped-wire tool which makes gas-tight interconnections with standard Teflzel insulated wire without time-consuming measuring, cutting and strip-

Hardware Tools

Company Name	Product Name	Available From	Retail Price	Keyboard	CRT	Terminal	CPU	Fl. Disk. Sys.	Printer	Mech. Tool	Elec. Tool	Circle No.
Abbeon Cal, Inc.	Plasti-Coat for Tools, Equipment	RE	$22.50 per gal.							•	•	53
All Star Products	Joystick Control and Console	MO	$ –		•	•						54
AP Products, Inc.	Logical Connection 16, 24 & 40 (pin)	RE, MO, DI	$10.00 to $35.00	•	•	•	•	•	•		•	55
Cambion (Cambridge Thermionic Corp.	24-pin PROM Protector Socket	RE, MO	$ –	•	•	•	•	•	•		•	56
Chemtronics	Micro-Duster Aerosol Spray	RE, DI	$2.50	•	•	•	•	•	•		•	57
The Computerist	Cables for KIM-1 to Memory Plus	MO	$10.00				•					58
Contact East	(Electonic Tool Catalog)	MO	N/C	•	•	•	•	•	•	•	•	59
Continental Specialties Corporation	LM-2 Logic Monitor	RE, MO	$129.95	•	•	•	•	•	•		•	60
Continental Specialties Corporation	203A Proto-Board	RE, MO	$124.95				•					61
Continental Specialties Corporation	LM-1 Logic Monitor	RE, MO	$59.95	•	•	•	•	•	•		•	62
Continental Specialties Corporation	LP-3 Logic-Probe	RE, MO	$69.95	•	•	•	•	•	•		•	63
Continental Specialties Corporation	Design Mate 4	RE, MO	$129.95	•	•	•	•	•	•		•	64
Control Products Division	Series RSB Single Screw Tri-Barrier Blocks	–	$ –	•	•	•	•	•	•	•	•	65
Deboke Co.,	CRT Tray	MO	$11.50		•	•					•	66
Dorien Products	Water Alert	MO RE	$45.00 to 75.00	•	•	•	•	•	•		•	67
Dremel Mfg.	Versatile Vise	RE	$21.95							•		68
Dynascan	B&K Precision DP-50 Logic Probe	–	$ –	•	•	•	•	•	•		•	69
E&L Instruments	Adam Breadboarding System	NG, MO, DI, RE	$ –									70
E&L Instruments	D-Bug Box	MO, DI, RE	$300.00 kit $400.00 asm.				•				•	71
E&L Instruments	LR-29 Input Port	MO, DI, RE	$25.00 kit $32.00 asm.				•				•	72
E&L Instruments	LR-36 Analog to Digital Converter	MO, DI, RE	$120.00 kit $140.00 asm.				•				•	73
E&L Instruments	LR-35 Digital to Analog Converter	MO, DI, RE	$100.00 kit $120.00 asm.				•				•	74
E&L Instruments	LR-50 Single Step Outboard	MO, DI, RE	$26.00 kit $40.00 asm.				•				•	75
E&L Instruments	LR-25 Breadboarding Station	MO, DI, RE	$30.50 kit $61.10 asm.				•				•	76
E&L Instruments	MMD/HEX Keypad	MO, DI, RE	$155.00 kit $185.00 asm.			•					•	77
E&L Instruments	MMD D-Bug PROM Set	MO, DI, RE	$100.00				•				•	78
Edsyn, Inc.	Silverstat Soldapullt	MO, RE	$ –	•	•	•	•	•	•		•	79
EICO Electronics Instrument Co., Inc.	Digital Multimeter Model 272	MO	$69.95	•	•	•	•	•	•		•	80
Electrolabs	ESAT 200A Terminal	MO	$329.00	•	•	•				•	•	81
Electronic Production Equipment Corp.	Micro-Shear Lead Flushcutters	MO	$ –	•	•	•	•	•	•	•		82
Electronic Systems	Modem Type 103-orig. or answer	RE, MO, DI	$27.50 kit	•	•	•	•				•	83
Electronic Systems	RF Modulator	RE, MO, DI	$13.50 kit	•	•	•					•	84
Electronic Systems	RS232/TTY Interface	RE, MO, DI	$7.00 kit	•	•	•					•	85
Electronic Systems	DC Power Supply ±5v, ±12 vdc)	RE, MO, DI	$42.00 kit		•	•	•	•			•	86
Extensys Corp.	Gutch Grabber for S100 bus	RE, MO	$79.50				•				•	87
Gruber Products, Co.	3128 Wheelit Sum-Line Folding Cart	–	$ –	•	•	•	•	•	•	•		88
Hybricon Corp.	Wire Wrap Pins (SP-1-2, CP-1-2, NP-1-2)	–	$19.50 to $150.00 per K	•	•	•	•	•	•	•		89
Hybricon Corp.	Edgeboard Connectors	–	$5.95 and up			•	•	•	•		•	90

Hardware Tools

Company Name	Product Name	Available From	Retail Price	Keyboard	CRT	Terminal	CPU	Fl. Disk. Sys.	Printer	Mech. Tool	Elec. Tool	Circle No.
Hybricon Corp.	Wire Wrapping Guns WWG-620B, WWG-615B	–	$105.75 and $131.50	•	•	•	•	•	•	•	•	91
Information Control Corp.	LP-220 Light Pen	MO	$195.00 approx.	•	•	•					•	92
Jade Computer Products	MS-15 Miniscope	RE, MO, RP	$289.00	•	•	•	•	•	•		•	93
Howard L. Johnson Co.	American Beauty V-3600 soldering station	MO	$ –	•	•	•	•	•	•		•	94
Jonard Industries Corp.	Wire Wrapping & Unwrap. (Catalog)	–	$ –	•	•	•	•	•	•	•	•	95
Klein Tools	Stripper/Cutter Tool (#1011)	–	$ –	•	•	•	•	•	•	•	•	96
Magnetic Information Systems	Cassette Media and Services	MO	$ –			•	•				•	97
Maine Mfg. Co.	Mobile Terminal Stand #10950	MO	$ –		•	•	•	•	•			52
Marketing Internat'l Inc.	Bran-Det Branding Iron	MO	$17.50	•	•	•	•	•	•	•	•	98
Methode Electronics, Inc.	Uni-Pac-2LED PCB Sockets	RE, DI	$ –	•		•	•	•	•		•	99
Micro Electronics Systems, Inc.	100 Series DIP Insertion Tools	MO, DI	$14.95 to $34.65	•	•	•	•	•	•	•		100
Micro Electronic Systems, Inc.	200 Series DIP Extraction Tools	MO, DI	$16.30 to $35.20	•	•	•	•	•	•	•		151
Midgard Electronics	UMB-Universal Mounting Board	MO	$13.25 per 100	•	•	•	•	•	•		•	152
Minicomputer Accessories Corp.	Three Cover Cassette Binder 2435-A	MO	$4.75 ea.			•	•					153
Minicomputer Accessories Corp.	Floppy Envelopes & 3-Ring Binder	MO	$11.95 ea.					•				154
Minicomputer Accessories Corp.	Minifloppy Envelopes & 3-Ring Binder	MO	$11.95 ea.					•				155
Minicomputer Associates Corp.	Lazy Susan #4851-A	MO	$44.95	•	•	•	•	•	•	•		156
Minitool	Micro Drilling Machine Model M	MO	$1125.00	•	•	•	•	•	•	•		157
Mitchell-Hughes Co.	Soldercraft 6A Miniature Sold. Iron	–	$ –	•	•	•	•	•	•	•		158
National Camera	(Catalog of Tools)	MO	N/C	•	•	•	•	•	•	•	•	159
OK Machine and Tool Corp.	WD Series Wire Dispenser	MO, RE, DI	$3.95 single color $5.95 tri color	•	•	•	•	•	•	•		160
OK Machine and Tool Corp.	WK-5 Wire Wrapping Kit	MO, RE, DI	$74.95	•	•	•	•	•	•	•		161
OK Machine and Tool Corp.	CON-1 Edge Connector with Wire Unwrapping Contacts	MO, RE, DI	$3.49 ea.	•	•	•	•	•	•	•		162
OK Machine and Tool Corp.	EW-8 Electric Wire Wrapping Tool	MO, RE, DI	$85.11	•	•	•	•	•	•	•		163
Periphicon	Type 511 Optical Image Digitizer	MO	$200.00		•	•					•	164
Pitts Enterprises	May Lee Computer Cassette Tapes	MO	$5.50 for 3			•	•			•	•	165
Phone 1, Inc.	P1-14 Card Reader Terminal	MO, RP	$1995.00	•	•	•	•			•	•	166
Printcraft Systems, Inc.	Desk Top ¼" Data Cartridge Storage	MO	$30.00 to $40.00		•	•	•			•	•	167
Ramsey Electronics	CT-50 Frequency	MO	$89.95 kit $159.95 asm.		•	•	•	•			•	168
Recortec	Microsette Short Length Cassettes	RE, MO	$ –			•	•			•	•	169
Robins Industries Corp.	Floppy Disk Hanging Storage Rack 78.053	–	$17.80			•		•		•		170
Robins Industries Corp.	Dust Collector Lint-Free Cleaning Cloth	–	$20.25	•	•	•	•	•	•	•		171
Sharp Electronics Corp.	ELTV: Electroluminescence Television	–	$ –		•	•					•	172

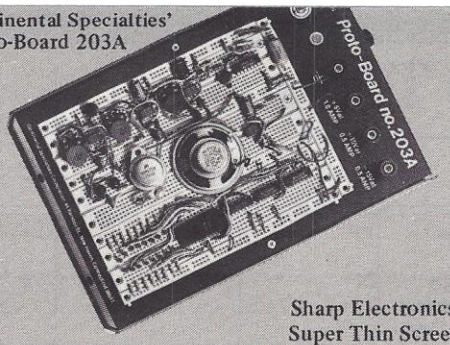
Hardware Tools

Company Name	Product Name	Available From	Retail Price	Keyboard	CRT	Terminal	CPU	Fl. Disk. Sys.	Printer	Mech. Tool	Elec. Tool	Circle No.
Shell Container Corp.	Cubby Mini Storage System	RP	$ –			•				•		173
Sperry Instruments, Inc.	Twin-Pak For Rotary Snap-Around Ammeter and SP-142 Multi-Tester	DI	$ –	•	•	•	•	•	•		•	174
Studio 3	The 3rd Hand	RE, MO	$9.95	•	•	•	•	•	•	•		175
Terminal Systems, Inc.	Automatic Answer Modem AAM300	RE, DI, RP	$350.00			•	•				•	176
Textool Products, Inc.	Zero Insertion Pressure Sockets (Catalog)	MO	N/C	•	•	•	•	•	•	•	•	177
3M Static Control System	Portable (Velostat) Field Service Kit (Electrostatic Protection)	MO	$24.80	•	•	•	•	•	•	•	•	178
Tyton Corporation	3" Wire Ties	–	$4.50 per 1000	•	•	•	•	•	•	•		179
Vaco Products Co.	70Z60 Super Case W/Tools	DI	$310.00	•	•	•	•	•	•	•	•	181
Vaco Products Co.	70380 Super Case II W/Tools	DI	$264.00	•	•	•	•	•	•	•	•	182
Vaco Products Co.	70390 Super Zip Case W/Tools	DI	$167.00	•	•	•	•	•	•	•	•	183
Vaco Products Co.	70420 Convertible Super Tool Set	DI	$160.00	•	•	•	•	•	•	•	•	184
Vaco Products Co.	89950 Economy Terminal Kit	DI	$35.00	•	•	•	•	•	•	•	•	185
Valtec Corporation	Tinkerlink Fiberoptics Data Link	–	$119.00	•	•	•	•				•	186
Vector Electronics Co., Inc.	4350 Plugboard	MO, DI	$14.95 ea.	•	•	•	•	•	•	•	•	187
Vector Electronic Co., Inc.	4607 Plugboard for	MO, DI	$15.95 ea.	•	•	•	•	•	•	•	•	188
Vector Electronics Co., Inc.	P187 Universal Termi-Terminating Fixture for IDC Cables	MO, DI	$29.50	•	•	•	•	•	•	•	•	189
Vector Electronic Co., Inc.	P184-4T1 117 VAC Pistol Grip Motorized Tefzel Wire Wrap Tool	MO, DI	$89.00	•	•	•	•	•	•	•	•	190
Vemco Corp.	Vemcolite VL-4 Telescoping Fluorescent Incandescent Fixture	RE	$119.50	•	•	•	•	•	•	•	•	191
Vertel	LC-31 Game Loader Magnetic Card Reader Encoder	–	$ –			•	•			•	•	192
Wescopr	Conducto-Mat (3x8') W/Snap Fastener for Ground Strap	–	$ –	•	•	•	•	•	•		•	51

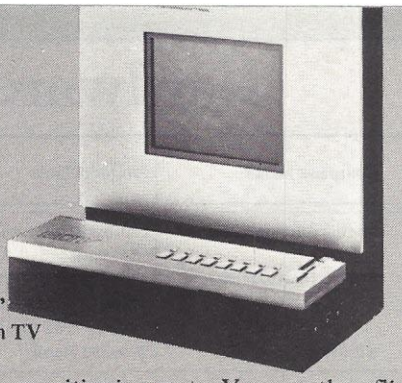
Software Tools

Company Name	Product Name	Available From	Retail Price	Planning	Flowcharting	Program Encoding	Inputtting Data	Debugging	Production Run	Instruction Aid	Graphic Aid	Circle No.
Alpha Supply Co.	Micro Coding Form	MO	$1.00	•		•	•	•				193
Berg Publications	Periodic Guide For Computerists	RE, MO	$5.00	•	•		•		•			194
The Computer Corner	Program 1 Cassette	RE, MO	$ .98				•		•			195
Fickled Thinking Aids	Fickled Thinking Aids Starter Kit	MO	$12.50	•	•	•	•	•	•	•	•	196
Gimix	DMXBUG	RE	$68.00			•	•	•	•	•	•	197
Graphic Products	Format & Formaline	RE	$ –	•	•					•	•	198
Minicomputer Associates Corp.	TI Programmer	MO	$59.95			•	•	•	•	•	•	199
Minicomputer Associates Corp.	Programmers Template	MO	$4.95	•	•	•	•	•		•	•	200

Continental Specialties' Logic Monitor LM-1



Continental Specialties' Proto-Board 203A



Sharp Electronics' Super Thin Screen TV

ping. "Daisy chain" terminations require about five seconds per post – less time than required to strip insulation from conventional wrapped wire. Vector Electronics also lists a universal fixture which simultaneously terminates 10 to 60 contacts of a ribbon cable onto nearly all IDC (insulation displacement connector) socket plugs.

Still another hardware product from Vector Electronic is significant to Heath computer owners. This general purpose prototyping circuit board permits convenient construction of custom interface circuits for Heath H11 microcomputers and DEC's LSI11, PDP8, and PDP11 minicomputers. The 4607 Plugboard, fabricated of blue epoxy-glass composite material, is priced at $15.95. Other items available include DIP sockets, terminals, connectors, PCBs, card cages, enclosures and complete packaging systems.

The "Glitch Grabber" from Extensys Corp., Mountain View, CA, a board interconnection device that significantly reduces noise, glitches and jitter on the S100 bus, carries a retail price of $79.50. This device provides glitch-free signals (no spikes, interference or cross-talk) by bringing some well-documented analog techniques from transmission-line analysis to the digital world of S100 computers.

3M Company constantly creates ingenious products to titilate engineers and hobbyists alike. This time they've developed a field service kit for electrostatic protection of static-sensitive devices. The kit contains Volume Conductive "Velostat" material (resistivity 3×10^3 ohm-cm) to provide an effective path to ground. The conductivity is unaffected by age and not dependent on humidity or other environmental factors. Check into this kit if you work with electronics in a dry, static-active environment.

Cambridge Thermionic Corporation, Cambridge, MA, lists a 24-pin PROM protector socket. This socket eliminates the possibility of damaging costly PROM and other 24-pin DIP packages that must be plugged and unplugged for changing and testing programs and trouble shooting systems.

Any 15 to 60 watt soldering iron plugs into American Beauty's V-3600 power unit to make a complete soldering station. The V-3600's solid-state circuitry regulates output voltage and wattage. Infinitely variable (stepless) dialing delivers from 0 to 100% of the line voltage, providing a wide range of tip temperatures with a single iron – even your ol' klunker.

If the slightest possibility exists that a flood could innundate your home, you should consider "Water Alert", a device that provides a loud high-pitched "on-off" alarm for up to 24 hours, a flashing light or a telephone call through an automatic dialer. Only a thin film of water on the surface monitored by Water Alert is needed to actuate the alarm. Immediate detection of water provides maximum response time to prevent extensive damage. The unit is roughly the shape of a Frisbee 6" in diameter and weighs about ten ounces. You can adjust this battery-operated unit to activate the alarm with a water film between 1/64 and 1/8 of an inch. Prices range from $45 to $75, depending on options – a small price to pay for peace of mind.

Vaco Products Company, Northbrook, IL, is one of several sources of tools packaged in anything from tool boxes to canvas bags to elegant executive attache cases. Prices vary extensively, but little is excluded from the list of tools Vaco offers.

Contact East, Burlington, MA, and National Camera, Englewood, CO, both offer a catalog of tools and miscellaneous devices to assist you in delicate assignments. Request both catalogs and keep them on file.

Studio 3, Kailua, HA, has one of the most sought-after gadgets for electronics hobbyists – a sturdy aluminum circuit board holder called the "3rd Hand". This "vise" clamps to the edge of your workbench, holding the board at a convenient angle for positioning parts. You can then flip the board forward to solder parts in place. A vinyl basket protects the board from damage while holding it securely in place. The open-end design allows the 3rd Hand to hold circuit boards of any size. This little gem costs $9.95 and is available from local dealers and from Studio 3.

A large catalog of small computer accessories is available from Minicomputer Accessories, Sunnyvale, CA. Thumbing through the pages, I spotted several items of interest. Instead of stacking boxes of cassettes in the bookshelf, order their Three Cover Cassette Binder which holds 12 cassettes and has a vinyl note pocket for 8½" x 11" paper. It sells for $4.75 (minimum order of 3).

Another storage device is the three-ring binder for storing 8" or 5¼" floppy disks. The floppies are stored in 16-mil clear vinyl envelopes that fit onto the rings of the binder. The spine of the binder offers a warning on x-radiation and electromagnetic radiation. $11.95 buys a black-with-white-lettering binder and ten flexible disk envelopes.

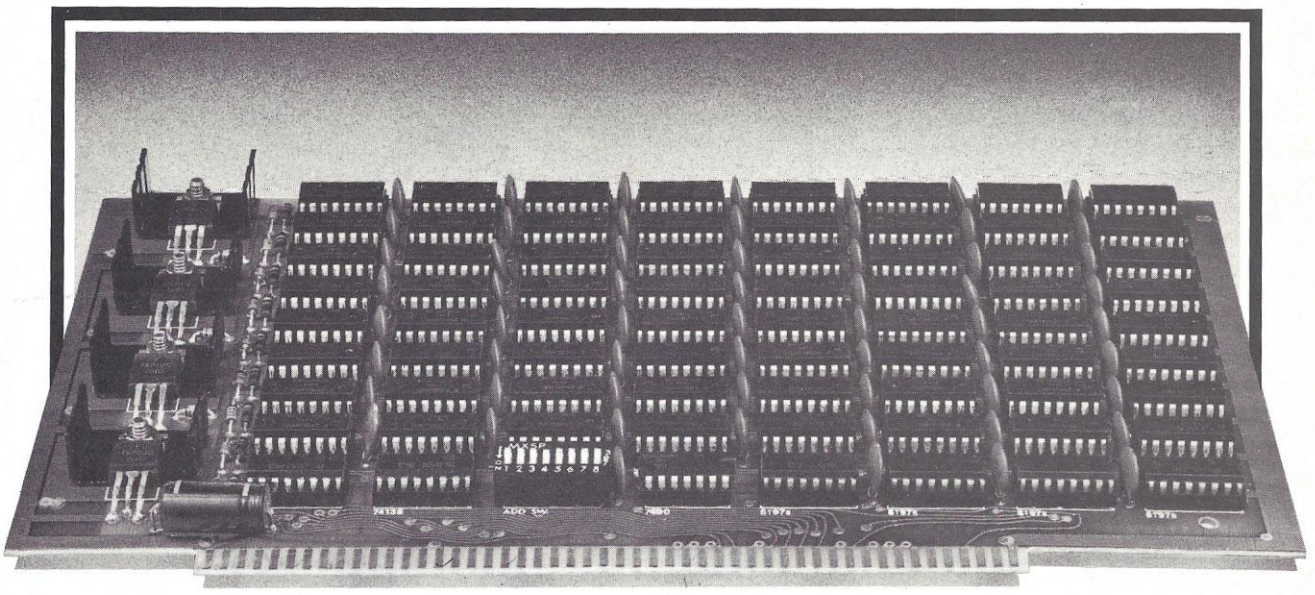
The Minicomputer Accessories catalog also lists two Lazy Susans for holding terminals. The smaller Susan is 16"l x 16"w x 1-3/16"d, holds 2000 pounds, offers 360° access to each terminal and sells for $44.95. The simulated walnut top is securely mounted with a smooth-rolling ball-bearing assembly to its base. This device could be very handy in demonstrating or teaching.

There are scores more tools, gadgets, devices and hardware/software aids. We've only examined a few. As new products develop in this area, we'll list them in our What's Coming Up (new products) section.

Examine the accompanying charts, circle on the reader service card the numbers corresponding to the products you're interested in and mail the card. We'll forward your requests for information to the manufacturers. In the interim, keep on toolin' with your micro. . .

SEALS is proud to announce...

OVER 20,000 UP AND RUNNING

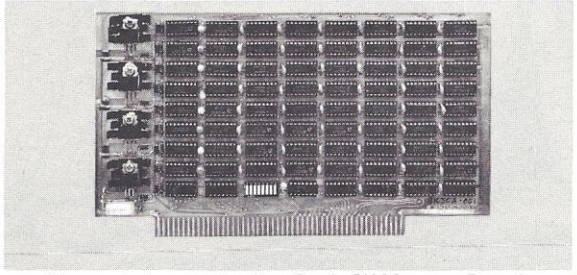


The amazing SEALS 8K memory

April 1978 marked the second anniversary of the first Seals 8K memory. And over the past two years Seals has delivered more than 20,000 8K memories.

If you already own a Seals 8K board, you know about performance and dependability. But if you are still looking for a memory you can depend on, it's time you asked your local retailer about Seals reliability. Seals is the memory that works the first time, and every time.

The Seals 8KSC pictured above is available in both slow (500 nsec.) and fast (250 nsec.) versions. There are also Seals 8K's for your 6800 computer--the Seals 68KSC and 68KSC-Z. All Seals memory boards come assembled and tested and include gold edge connectors, sockets for all ICs, all address, control and data out lines fully buffered, and many more important features.



Pictured above is the first Seals 8K Memory Board # S/N 0001. The board that worked the first time.

When the time comes for your computer to remember more, you'll want to remember Seals--the memory people. Seals product reliability is a standard in the industry--the standard your system deserves. For performance and dependability you can count on, ask your retailer for memories and accessories from Seals Electronics.

The board pictured below is the very first Seals 8K ever assembled--S/N 0001. If you are a Seals 8K owner, you won't be surprised to know that this board has seen long and demanding service and was still up and running in a TVA computer in Tennessee when it was removed to be photographed.

Since Seals products are distributed through retailers throughout the country, we at Seals really don't know where all the 8K's are or how they are being used. If you already own a Seals 8K, we would like to hear from you. Just drop a note to our Marketing Division at 10728 Dutchtown Road, Concord, TN. 37922.

If you would like information on the full Seals product line, and a list of retailers in your area, write to the same address or call (615) 966-8771.

SEALS ELECTRONICS
INCORPORATED

CIRCLE 16

The People Speak Out

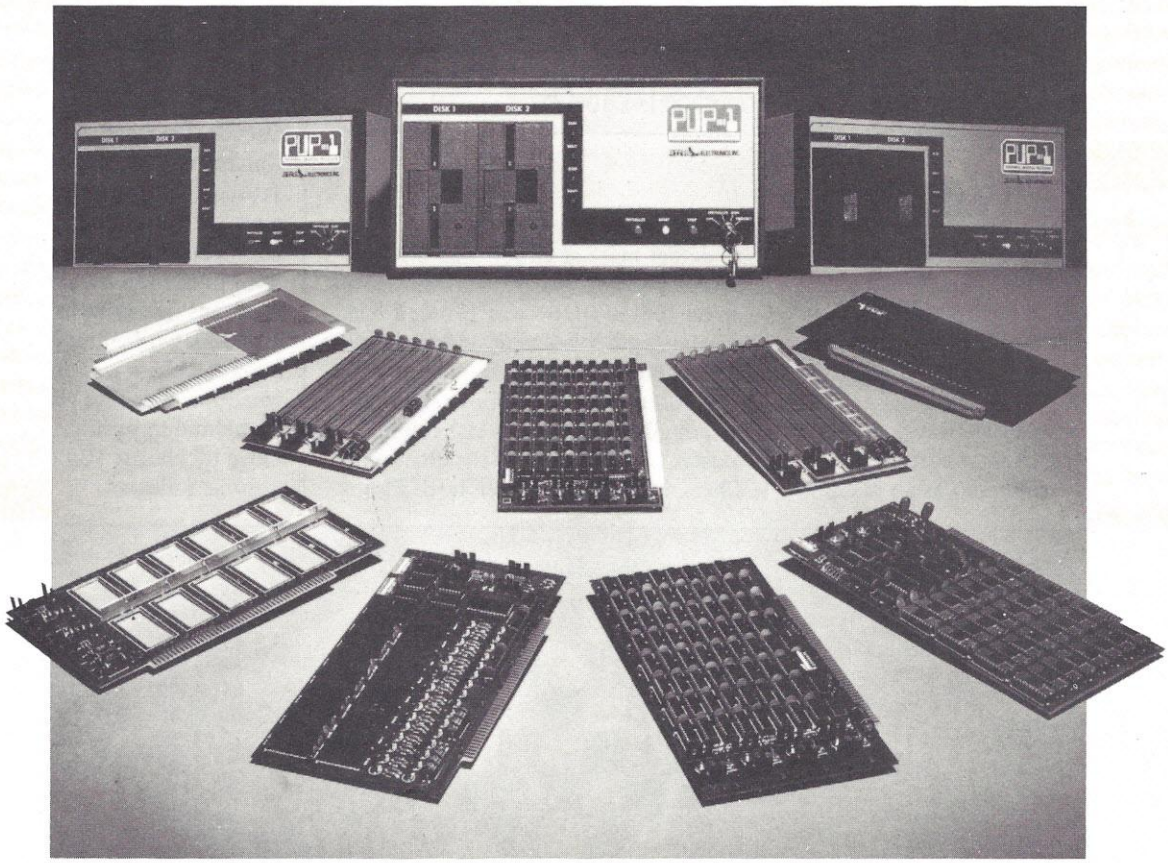
. . . This letter from Charles Derr of Boynton Beach, FL 33435 (Box 488) describes his problems with chess machines. "I have absolutely no knowledge of chess with real computers," writes Charles. "But I bought a Chess Challenger II on 10/10/77, Compu Chess on 4/6/78 and Boris 5/5/78. I had never seen chess played until I was past 50, then got interested and played for several years, mostly by mail. After a coronary I gave it up, then became re-interested a few years ago, but found little interest in the game among the 1500 residents of our retirement condominium, so turned to the machines for chess play. I do belong to the Chess Club in Delray Beach, which meets for 3½ hours once a week, but I'd like to play 3 or 4 times per week, at least; I hope some day to find another retiree nearby with comparable interest and ability.

In my opinion, Compu Chess is a total 'flop'. It advertises six levels of play but after 120 full hours of waiting, it had not responded to my sixth move in a game at level 6, so I gave it up and wrote the Company; they replied that actually only the four levels are suitable for games, the fifth and sixth levels intended for problems such as mate-in-two, etc. At its 4th level it lost badly to Challenger II's third level, but I have records of over 200 games I have played against Challenger, both as white and as black, and have lost only two or three games. I have had Boris only 3 days, and think he is sadly overrated. I pitted him as black vs. Challenger II as white; at move 10 white could have played B x P check; K x P was forced; then Q x Q with no recourse. But Challenger did not 'see' that move and it finally lost the game. I played white against Boris today, three minutes for its moves.

This variable time response is a good feature of Boris but the use of symbols for chess men, such as ♖ for Rook and ♕ for Queen is a very bad feature – captured his Queen with my Bishop at move 11; in the next game, also at 3 minutes, he lost his Queen for a Knight in 10 moves. I keep a record of these games if anyone is interested. I find these 'gadgets' interesting as a pastime for someone in my circumstances but wouldn't recommend them unless the person is familiar with their disadvantages. For example, Boris and Compu can be set up in mid-game in minutes, but Challenger must be fed each move

Illustration by Nancy Lawrence

What you should know about the Seals Retail Program.



The performance-packed family of Seals products featuring (lower left to right) BBUC, 4KROM, 8KSC, 16KSC, (middle left to right) 68EXT large and small, 68WWC, 68KSC, 88WWC, 88EXT (top) PUP-1 computer.

At Seals Electronics we believe in specialization. We concentrate on manufacturing a reliable line of microcomputer products so that you, the retailer, can concentrate on sales.

When you are a Seals dealer you can depend on Seals for:

- Dependable, quality hardware with an industry wide reputation for excellent performance.
- A marketing program designed to support you at the point-of-sale.
- Price margins that give you the best possible advantage and recognize that you need profits to operate.
- A staff of marketing and technical specialists who are interested in you and your business.

The people at Seals have been in the microcomputer business for a long time. We know that the computer retailer needs and deserves the very best possible support from a manufacturer. We are constantly on the alert to improve our retail program. Seals works with you to increase your sales and assure you satisfied customers. We don't ask that you be a manufacturer (all our products are available assembled and tested) and we know you don't want us to be a retailer.

The 1977 Computer Store Survey published by Image Resources gave Seals Electronics consistently high ratings in the areas of product image, value to customers (product reliability and documentation), and dealer interface with manufacturers.

We are proud of our record with retailers and are working hard to improve our position in the industry. We would like to work with you.

For current literature on the Seals microcomputer product line and/or more information on our retail program, call or write our Marketing Department, Seals Electronics, 10728 Dutchtown Road, Concord, TN 37922, (615) 966-8771.

Dealer support is more than just words to us.

SEALS ELECTRONICS
INCORPORATED

CIRCLE 17

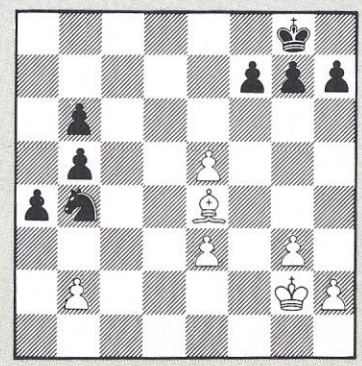
individually, but with no waiting time. The makers of both Challenger and Compu speak of up-grading their machines, for a price, some time in the future. Incidentally, The Challenger mentioned on page 8 of Newsletter issue #1 is probably the original $200 Challenger which could play black only; II can play white or black and has 3 levels of play. The Heath-kit people were offering Challenger II at $200 less 10%."

Toronto Tally

. . . The final round at Toronto saw a game played between **Duchess** and **Master. Master** had come into the tournament seeded No. 3. A program from Rutherford Labs, Harwell, England, it was authored by J.A. Birmingham and Peter Kent using PL/1. Rated as one of the world's top chess programs, its main known weakness was an inability to detect mate at closer than 3 ply. Memory size of **Master**, which was run on an IBM 370/168 was 170K; it had an opening book size of 450 variations; and could consider an average of 100,000 positions per move. Before meeting **Duchess** in this last round, **Master** had lost only to the champion **Chess 4.6** and had beaten both **Elsa** and **Chute 1.2.** Certainly, it was the favorite going into the match with **Duchess. Duchess,** however, was not going to be a push-over. It had already beaten last year's champ, **Kaissa** and had trounced a program considered strong, **Ostrich. Duchess,** the entry from Duke University, NC, was authored by Tom Truscott, Bruce Wright and Eric Jennings. It had a program size of 300K, with a book opening of 3,000 variations but could consider only 1,200 positions per move as against **Master's** 100,000. On memory size and opening book, **Duchess** was obviously the overwhelming favorite. However, it lagged far behind in positions examined per move by almost 100 to 1. The game went as follows:

White: **Master** Black: **Duchess**

1. N-KB3	N-KB3	25. P-Q5	PxP
2. P-QB4	P-Q4	26. QxP	QxQ
3. PxP	NxP	27. BxQ	N-N5
4. P-KN3	P-QB3	28. B-K4	B-B4
5. B-N2	P-K3	29. K-N2	BxB
6. 0-0	B-K2	30. PxB(see fig)	P-KR3
7. P-Q4	0-0	31. K-B3	K-B1
8. P-K4	N-B3	32. P-R4	K-K2
9. N-B3	P-QN3	33. P-R5	K-K3
10. N-K5	B-R3	34. K-B4	N-Q4 ch
11. R-K1	Q-B1	35. BxN ch	KxB
12. B-K3	QN-Q2	36. P-KN4	P-N5
13. NxN	QxN	37. K-B5	P-R6
14. P-K5	N-Q4	38. P-K4 ch	K-B4
15. Q-R4	B-N4	39. PxP	PxP
16. NxB	PxN	40. P-K6	PxP ch
17. Q-N3	KR-Q1	41. K-K5	P-R7
18. B-Q2	QR-B1	42. KxP	P-R8=Q
19. QR-B1	P-QR4	43. P-N5	PxP
20. RxR	RxR	44. P-K5	Q-Q5
21. R-QB1	RxR ch	45. K-B5	Q-KB5 ch
22. BxR	P-R5	46. K-K6	P-N5
23. Q-Q1	N-N5	47. K-K7	P-N6
24. B-K3	NxRP	Black Wins	



Position after White's 30th move. Both antagonists have played agressively and have manipulated their major pieces rather than advance the pawns. Having knocked off each other's big pieces they begin the pawn game in earnest. However, **Duchess** has an obvious advantage both in the number of pieces on board and the clustered, protected formation.

Some San Jose Color

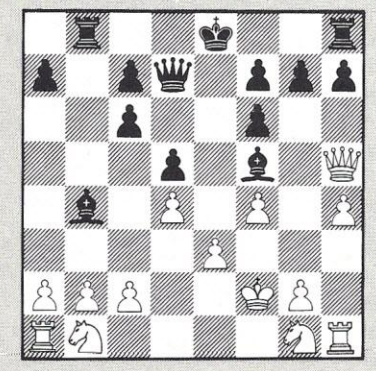
. . . At the San Jose Microcomputer Chess Tournament in March, (in which Kathe and Dan Spracklen came away with top honors) two machines, both of which floundered to the bottom of their classes in position, played each other. One machine, Compucolor, displayed a colorful chessboard on its VDT lending a carnival atmosphere to the proceedings. The opponent was Steve Stuart who had whipped-up a "homebred" machine costing "peanuts." Description of the two competitors: Compucolor consisted of software for 8001 or Apple II and was used to demonstrate a very attractive high resolution color display; Steve Stuart strung together a 2650 chip plus 2K RAM and other parts, including a shiny metal box, all of which cost him $85. The two "contraptions" indulged in a brief game that is here annotated by Alan Benson, Senior Regional VP of the USCF, and ICCF Postal Master:

ACM's 9th

. . . The Ninth North American Computer Chess Championship tournament, sponsored by Association for Computing Machinery, takes place in Washington DC from Dec. 3 to 5th. Individuals interested in participating should write to Prof. M.M. Newborn, School of Computer Science, McGill University, Montreal, Quebec H3A 2K6 Canada. Deadline for entries is October 20, 1978.

White: Compucolor Black: Steve Stuart

1. P-Q4	P-Q4
2. B-N5	N-KB3
3. P-K3	N-B3
4. B-N5	B-B5
5. BxN ch	PxB
6. BxN	KPxB
7. P-KB4	B-QN5 ch
8. K-B2 (a)	R-N1
9. Q-R5	Q-Q2
10. P-KR4 (b)	0-0
11. P-R4	KR-K1
12. P-N4	BxP (c)
13. QxB	QxQ
14. P-K4 (d)	QxKBP ch
15. K-N2	QxP ch
16. N-B3	Q-K7 ch
17. K-N1 (e)	QxN
18. R-KR2 (f)	R-K8 mate



Position after White's 14th move: One flip onlooker was heard to remark at this point, "White's queen should be wearing colored glasses so she could see where she is going!"

Annotations by Alan Benson

(a) Certainly not 8. Nc3 allowing 8 . . . Bc3:+!?! I must admit that I haven't seen a quicker way to exchange both loving bishops so fast as Compucolor did in this game.

(b) Whoops! allows black to trap the queen with 10 . . . Bg 4. This threat is executed after the bishop is attacked on the 12th move.

(c) Finally!

(d) A horrible move –weakens the KBP for no reason.

(e) 17. Kg3 isn't much better for after 17 . . .Re+ mates shortly.

(f) Only 18. Nc3 holds out a few more moves after 18 . . . Bc3: 19. bc:, Re2 and mates in three. Nice little game by Stuart's machine.

Chess-book Review

. . . Doug Penrod sends the following review of "A Computer Chess Program in Z-80 Assembly Language" ©1978 by Dan & Kathe Spracklen, (winners of the San Jose Tournament) 10832 Macouba Place, San Diego, CA 92124. Cost of the 8½" x 11", 75+3 page book, is $15, in comb binding. In his review Doug says:

"I regard this publication as a real landmark in computer chess literature, and a must for the library shelf of anyone that is at all seriously interested in computer chess.

"This program SARGON, easily won the hobby computer chess tournament held in San Jose, California from March 3rd through 5th, 1978. In fact, it won all 5 of its 5 games in the tournament, although it lost to a chess master in an exhibition game afterward.

"The book contains a complete table of contents, a block diagram of the program, and a 4-part introduction, an assembly language listing of the program (the bulk of the book), and an index to the subroutines.

"Four pages of the introduction are devoted to a thorough description and explanation of the program. This is so instructive that you may feel that it alone is worth the price. This is followed by 8 pages on the graphics display. This illustrated section explains in great detail how the display is generated and used. The display shows the chess board with a pictorial representation of the chess pieces, plus a listing of the moves in algebraic notation.

"The 5 page section 'Users Guide to SARGON' describes how to load the program, and how to play chess against SARGON. The user can play black or white, and can select the depth of look-ahead, from 1 to 6 ply. Moves are entered in algebraic chess notation. This section tells how to castle, to capture en passant, how to correct an erroneous move, even how to resign. The user can set up a board position for chess problems. The documentation here is complete and unambiguous, unlike that for most computer games. This book is a model of proper documentation, and a great contrast to the documentation found throughout the hobby computer industry. The last part of the introduction is a page 'Notes on the Implementation of Sargon.'

"The bulk of the book is of course the assembly language listing of the chess program. This is heavily commented. The purpose of each table and subroutine is described, and the meaning and purpose of the variable names. For example: 'WACT – White Attack Count. This is the first byte of the array and tells how many pieces are in the white portion of the attack list.'

"Within the program proper, nearly every line of assembly code is commented, so that it is very easy for a reader to follow the logic of the program. I am greatly impressed with the clarity and adequacy of the comments. This program was assembled using the TDL assembler. The mnemonics differ a little from those used by ZILOG. If you wish to use the program, you must change those mnemonics which differ from those used by your assembler.

"The Z-80 was derived from the 8080, and the 8080 instruction set is upward compatible with that of the Z-80. Hence, the 8080 would be the easiest case for conversion of this program for use with another microprocessor. Someone who successfully undertakes this task might make arrangements with the Spracklens for them to market the 8080 version along with the original.

"A more difficult task would be the conversion of the program into the assembly language of an unrelated processor, such as the 6800 or the 6502. But it would certainly be easier, more mechanical and faster, than writing a good chess program from scratch. In principle, a program could be written to perform the conversion. If successful, a program should enjoy a brisk market.

"Even the conversion of SARGON to BASIC or some other high-level language should be straightforward, due to the clear and thorough documentation of this version. Of course, arrangements would have to be made with the Spracklens to market any version of SARGON in whatever language.

"SARGON occupies 8k bytes of memory – 2K for data areas, 2K for the graphics display and user interface, and 4K of move logic. At the tournament SARGON was running on a Wavemate Jupiter III using a 2MHz clock. If your Z-80 machine uses a 4MHz clock and memory, SARGON will run twice as fast. Computer chess is one application where speed is important.

"In summary, I heartily recommend this book with no reservations.

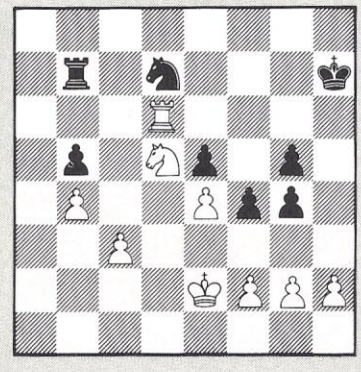
"There are other publications which a student of computer chess should read and have available for reference. A list of computer chess books in English was printed in the Computer Chess Newsletter. A basic item is the new $1.00 bibliography by Tony Marsland, described on page 112 of the May 1978 issue of Personal Computing and still available in a new printing. Some of the items in this bibliography will be serially published in the Computer Chess column. Some items may be difficult to track down and obtain. But reading can save a student of computer chess an enormous amount of time and re-invention, and is highly productive for anyone who would like to write his own computer chess program."

Long Haul at Seattle

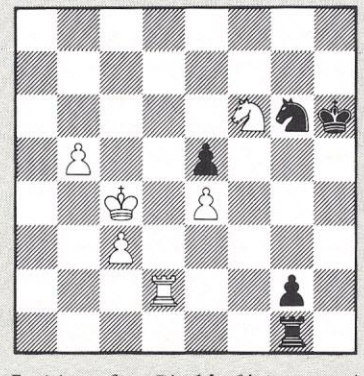
. . . During David Levy's simultaneous exhibition during the Seattle computer tournament this past October, he ran into a tough opponent in *Xenarbor*, which finished third in the tournament. This program was developed by Donald Miller of Control Data-Data Service. It had participated in several past ACM tournaments and had, to its credit, an impressive win against a 1437 USCF rated opponent (though hardly at the level of David Levy). *Xenarbor* runs on an IBM 370/158, is written in FORTRAN and requires 130K bytes. It searches a tree of about 10,000 positions when considering each move. It has, however, a small opening library. There were more impressive programs opposing Levy at the exhibition. It came as a great surprise then to many onlookers when *Xenarbor* forced the game into 75 moves, longest of the exhibition, giving David quite a struggle:

White: **Levy** Black: **Xenarbor**

1. P-K4	P-QB4	39. PxP	PxP
2. N-KB3	N-QB3	40. N-K7	K-R2
3. P-Q4	PxP	41. N-B5	R-B2
4. NxP	N-KB3	42. K-Q3	K-R1
5. N-QB3	P-K4	43. NxP	K-R2
6. N/4-N5	P-Q3	44. N-B5	N-B1
7. B-N5	P-QR3	45. N-K3	N-N3
8. N-R3	P-N4	46. P-N3	R-B2
9. N-Q5	B-K2	47. K-K2	R-R2
10. BxN	BxB	48. N-Q5	R-R7 ch
11. P-QB3	0-0	49. K-K3	R-KN7
12. N-B2	B-N4	50. N-B6 ch	K-R1
13. B-Q3	B-K3	51. R-Q8 ch	K-N2
14. N/2-K3	BxN/6	52. N-R5ch	K-R2
15. NxB	Q-Q2	53. R-QN8	R-QB7
16. 0-0	QR-N1	54. K-Q3	R-B7
17. P-QN4	N-K2	55. RxP	RxP ch
18. P-QR4	Q-B3	56. K-B4	P-N5
19. PxP	PxP	57. R-N6	K-R3
20. Q-B2	R-N3	58. N-B6	RxNP
21. R-QR3	R/B-N1	59. P-N5	R-N8
22. R/B-R1	Q-B1	60. R-Q6	P-N6
23. R-R7	N-B3	61. R-Q2	P-N7
24. R/7-R3	R/3-N2	62. N-N4 ch	K-R2
25. N-Q5	P-B4	63. N-K3	N-B5
26. N-K3	P-B5	64. P-N6	R-N8
27. N-Q5	P-R3	65. NxP	RxP
28. Q-R2	K-R2	66. NxN	PxN
29. R-R8	RxR	67. R-KB2	R-KB3
30. QxR	QxQ	68. P-K5	R-B2
31. RxQ	N-N1	69. K-Q5	R-Q2 ch
32. K-B1	P-R4	70. K-K4	R-QB2
33. B-K2	B-KN5	71. R-B3	R-B5 ch
34. BxB	PxB	72. K-Q5	R-R5
35. K-K2	N-Q2	73. P-B4	R-R1
36. R-R6	P-N4	74. RxP	R-Q1 ch
37. RxP	K-N2	75. K-K6	Resigned
38. P-B3	P-N6		



Position after White's 37th move. White snitches a pawn. This one-up situation is now maintained by White to give him an advantage.



Position after Black's 61st move. At this point it is evident that Black's threat to queen his pawn has been stymied by White's rook.

Errare Humanum Est

. . . To anyone who has ever studied elementary Latin that phrase is the classic admonishment that "To err is human." We certainly errared when we first reported Toronto Tournament results and gave some wrong info. Coordinator of that tournament was *not* Prof. D. Michie, as mentioned. Actual Tournament Coordinators were Prof. Monroe Newborn of McGill University and Prof. Benjamin Mittman of Northwestern University. These two energetic workers have functioned in the same capacity for all U.S. and North American championships (except for the first one in 1970 which was organized by Prof. Newborn himself.) The two have also coordinated the operation of the two world computer championships. David Levy, funtioning as Tournament Director, has worked with Professors Newborn and Mittman in all these activities. (Local arrangements in Toronto were handled by Prof. Vranesic and Mike Valenti.)

Errare Humanum Est Again

. . . David Berroth of Colorado points out errors in some game scores we listed: "The articles on computer chess are very interesting," he writes. "But so full of mistakes, they're frustrating. I have corrected them when possible but some games couldn't be reconstructed which ruined my fun of replaying them. The following errors appeared in your May '78 edition:

Wita vs. **Tyro**
6. H-KB3 to N-KB3
20. RXR, add check

Tell vs. **Dark Horse**
2. B-QB3 to N-QBs
15. R-QB1 to R-QN1 (for 17. R-47)

etc., etc., etc., etc. It's really a shame you couldn't record the moves any better. One of the programs seemed to be recording moves from the Black side while playing the White side. Strange, but amusing!"

(Ed. response:
The objections you raise are certainly justified. Many of the games played at tournaments, because they come to us in batches are inserted for publication without checking with the hope they are correct. It is a troubleshome burden to play through every game in time to meet a publication deadline. Games in which diagrams appear, are however, played out by us, to make sure the game is correctly notated. Often it is not and we track down corrections. At computer tournaments each team keeps its own notes. Some notes are recorded in English Notation, some in Algebraic and some in combination of both. The notes are then typed up and made into photostats. Many errors manage to appear between the original note-taking and the final typing. And when we get them, typsetting errors manage to slip by the proofreader – a common occurrence in every publication. Often, playing out some of the games we find moves missing, wrong moves, repeated moves, etc. These games we delete. Hopefully, as we cut down on the number of games published and play out those games we do use, errors will be less common and – hopefully, non-existent. Also, our art department is becoming more proficient in reproducing chess diagrams. You may not be aware that we have also published a game in which White had two Queens. . . . "Oh! Dear!")

Checker Challenger

. . . Fidelity Electronics, of Chicago, IL has a new "Checker Challenger" computerized game similar to their "Chess Challenger." The Checker Challenger is adaptable to any one of four levels of play and its method of operation is quickly learned by a player who "wants to take on the machine." Dick Fortman, President of Illinois State Checker Association and Games Editor of the American Checker Federation evaluates and describes Fidelity's new computer-game in the following letter:

"I have long felt that present-day computers are incapable of playing scientific checkers, except on a low-grade amateurish scale, and this opinion was substantiated after annotating the Duke Univ. vs. Stanford Univ. computer games, which were recently published in the ACF Bulletin.

"When I first received word from Fidelity Corp. that they were in the process of marketing a desk-size electronics game (an exact duplicate of the 'Chess Challenger' both in design and size.) at a reasonable price, I was naturally very interested but skeptical; especially when I was informed that this game had been programmed by their own company engineers.

"After receiving the 'Checker Challenger', Model ACR-1, on a 30 day loan, and after working with it for just a few hours, I found that my prejudged opinion was erroneous. Here, I must admit to a total lack of knowledge concerning the 'micro-processor chips' which are the brains of this computer, and I am completely in the dark as to their operation, but in any case, they are capable of producing some astonishing results.

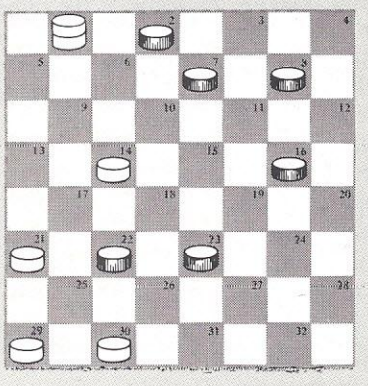
"The model that *I* have operates on 5 different levels of skill. At level 1, it responds almost immediately, and although it never makes an illegal move (nor does it permit one) its play here is at a beginner's level, which would certainly amuse the youngsters, and perhaps give them an incentive to pursue the game further. At level 2, it plays a bit stronger, and replies in about 5 seconds, 'looking' at 2 options. During this process, 4 zeros appear on the screen, and move up and down at various speeds (faster at lower levels) during this scanning process. Although the average player, with some knowledge of scientific play can usually win at this level, it is fun to play 'speed' checkers against it.

"At level 3, the response time averages 25 to 30 seconds, and here operates on a more sophisticated scale, but still may commit positional errors; some perhaps only discernable to the experienced opponent. The highest advertised level 4 replies on an average of 90 seconds, and is capable of drawing or winning against a Class B state

tourney player. One higher level (5) is available, and can be produced by keying in a set of numbers, but since its response time averages about minutes, the manufacturer rightly feels that this would detract from the game's interest, except to the expert player. I have yet to determine the difference in playing skill between levels 4 and 5 in actual game play.

"This last named is most intriguing to me, wherein any problem, game position, etc. can be programmed into the computor after first clearing its memory of all pieces, and then inserting the desired setting by squares. At levels 4 and 5, it has shown me some exceptional technique, as given in the following "end game" example:

White: Fortman Black: Challenger



1. 29-25	22-29
2. 30-25	29-22
3. 21-17	22-13
4. 14-9	13-6
5. 1-10-3-12-19-26	2-7
6. 26-23	White Wins

What is most impressive to me, is the results acheived in positions inserted into the computer. Here, one must remember that the computer is not given terms (such as W. to move & win, or draw) which the human player has, but is given only the move. Here, I have discovered that it invariably goes for the win (if such exists) instead of allowing a draw. Fortunately enough, for us checker players, its overall results are not perfect, and it does not grasp positional nuances but its tactics are sometimes superb.

As of the present writing, I have not had the time or the opportunity to explore level 4 and 5 actual game play, but I intend to do this in the near future."

From Checker Secretary

. . . Along with Dick Fortman's letter, came a short note from W.B. Grandjean, Secretary of American Checker Federation, 3475 Belmont Avenue, Baton Rouge, LA 70808. "The 'Checker Challenger' was expected to compete in the Major division of the Checker National Tournament held in July at Murfreesboro, Tenn. More news on that event will be forthcoming. If any readers of PERSONAL COMPUTING can refer to me a checker program suitable for a Heath H-8/H-9 16 K system, I would appreciate hearing from them. The '101 Basic Games' checker (?) program is a board game of some sort, but whatever it is, it is not checkers. In the field of computer checkers (comparable to computer chess) if interest develops, I believe the American Checker Federation might provide a suitable stake (a la Levy vs chess) for matching a computer checker program in a challenge match with *our* world champion, Dr. Marion F. Tinsley, Florida A & M."

Computer Checkers

. . . The following letter from Tom Truscott, Duke University, Durham, NC 27706, describes the latent interest in computer checkers. "I am pleased that computer checkers is included in the computer chess department of Personal Computing. There is a substantial interest in computer checkers. Contrary to many published statements computer checkers does not surpass that of the best human players, and it certainly has not 'solved' the same. *Also, checkers may be implemented on even the smallest computers.* Enclosed is a paper on the relevance of game-playing computer checker programs by Dr. Bierman, associate professor of computer science at Duke."
(Dr. Bierman's paper follows:)

"Theoretical Issues Related to Computer Game Playing Programs by Alan W. Biermann

"Two years ago CHESS 4.5 achieved a perfect record in the Class B section of the Paul Masson American Chess Championships. More recently, a checkers program from Duke, written by Eric Jensen and Tom Truscott, played five games against Elbert Lowder, North Carolina champion, (who placed fourth in the last national checker championships,) and the computer program achieved a record of draw, draw, win, loss, and loss.

"It is reasonable after these recent successes to examine what has been accomplished and to assess the value of continued efforts along these lines. Are game playing programs simply an expensive amusement for a small number of clever programmers or does the game playing effort constitute a legitimate part of our developing computer science? This short note is written to argue that the latter is true and that, in fact, game playing research has made contributions that no serious computer scientist can ignore.

"It would seem, after all, that the major goals of computer science are to discover how to increase the capabilities of machines and that the domain of games offers a perfect laboratory for studying complex problem solving behavior. We would like for machines to help us solve problems in many areas, business, government, medical, scientific, legal and others, but in each of these areas we find it extremely difficult to build into the machine a world model which is complete enough and accurate enough to enable it to do nontrivial decision making of the type that humans routinely do. Also in these applied areas, it is not necessarily easy to judge whether the decision maker, man or machine, is making good decisions because there are few commonly accepted measures of goodness. On the other hand, in a game like checkers or chess, the machine can hold and properly model all of the relevant information about the particular game and the measure of the quality of its behavior is absolute. One simply plays it against a competitor and observes whether or not it can win the game. It is also quite fortunate that there are a number of human experts in each of these games so that we can study their performance in contrast to that of machines and learn a little more about both.

"The last twenty years of game

playing research have actually produced some tremendous surprises about what humans and machines can do. At the risk of over-simplifying the discussion somewhat, I will give three results which I feel this work has achieved. In each case, I believe that the result was a surprise in the sense that there were large numbers of very able people who had predicted (sometimes in print) that the opposite result would be found.

"The first surprise came in the early days of computer science when machines were initially becoming available. It appeared in those days, for example, that checker experts examine only a few dozen possible boards before making a move and that a machine would be able to look at hundreds of such boards. Against such odds, it seemed that a human would have a slim chance of making a showing. Major scientists were predicting that a computer would win the chess championship of the world within a few years. The suprise, however, was that a few years later when chess and checker programs were examining not hundreds but many thousands of positions, they were only able to achieve the most mediocre play.

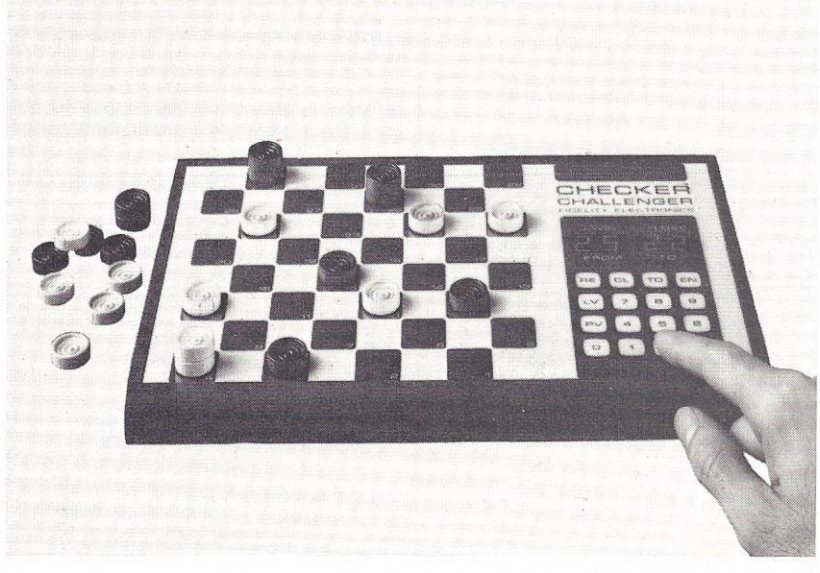
"It was then decided that humans must have some kind of pattern recognition ability which enabled them to recognize the value of a position without search and that similar abilities must be designed into the mechanical players. This led to a long series of studies to develop pattern recognition abilities which would make it possible to evaluate boards as expert humans do. It was felt that adequate board evaluation would greatly improve play and make it unnecessary to expend so much computation on search.

"At the same time, other innovations were made to improve programs. Attempts were made to design an ability to select relevant parts of the board for extended search and omit other portions of the search, to design strategic or top level planning mechanisms, and so forth. While these various developments were being made, programs were improving to the point where they could beat rank amateurs in chess and checkers but their total performance was still disappointing.

"The second great surprise, it seems to me, is that these studies have been going on for fifteen or more years and they have still not yielded chess or checker programs which can win consistently against experts. In other words, both the attempt to defeat man with speed and the attempt to outclass his planning and pattern recognition abilities have failed and no combination of these abilities has been found which can win a world championship. Considering the incredible speed and memory capacity of machines and the long years of research in this field, I think it is astounding that man's mind still reigns supreme in these well defined and tightly constrained environments. It seems to me that this particular failure of computer science gives us an extremely important data point for helping us judge what we can and cannot do with machines.

"But game playing research during the 1970's has been preparing what I feel is its third major result. After having been thoroughly convinced twenty years ago that uniform search would never succeed in producing high quality game players, the Northwestern program in chess and the Jensen-Truscott program in checkers have come along to give the best machine play yet. Both of these programs largely discard the heuristic methods for planning and evaluation developed over the past two decades but they do use a number of tree searching ideas that have appeared: "iterative alpha-beta," "hash table" look-up cutoffs, "obvious moves" and many others. The theory behind these programs is that they will concentrate on doing what machines do best, processing large amounts of data in a simple and uniform way and that the best performance will not be achieved by trying to simulate man's thinking processes. That is, until the machine planning and evaluation technology improves tremendously, search will be used as well as possible to substitute for these functions.

"In summary, and with considerable over-simplification, I would say that over the past twenty years, the game playing effort has gone through the phases of believing that looking at more board positions would be enough to build superior game



"CHECKER CHALLENGER" by Fidelity Electronics, 5245 Diversity Ave., Chicago, IL 60639 is a computerized checker game that offers four levels of play: one offensive and one defensive move (good for beginners): two offensive and two defensive moves (good for experienced players); three offensive and three defensive moves (good for advanced players); and four offensive and three defensive moves for experts. A level-five version is available from the company for those who can knock off level four easily.

players, of believing that human pattern recognition and planning mechanisms could be simulated, and, more recently, of turning to faster search mechanisms in order to make up for our failure to simulate humans.
While it is not easy to show that these studies are directly related to solving the world's problems, I believe they do furnish us with some extremely worthwhile data points which help us judge what computer science can do and how it can do it. Just as automata theory may not be used by practicing computer scientists on a day-to-day basis, it does supply us with important background information such as the fact that some problems are unsolvable and other problems are very hard. From game playing research and other studies as well, we have learned that just because machines can store vast amounts of information more than humans and can process it faster and more systematically than humans is no sign that machines can make better decisions than humans based on that information. Similarly we have found that even huge investments in designing pattern recognition and evaluation mechanisms have not made them even more remotely comparable in power to human abilities. However, in some restricted domains we can partially make up for these deficiencies by building efficient search algorithms.

"In conclusion, I should say that game playing research is an important and thriving research effort today at many of the more prestigious research institutes and universities. This work is referenced repeatedly in almost any discussion on the capabilities and shortcomings of computers as decision making devices. Arthur Samuel told me (if I remember correctly) that he received approximately 10,000 requests for his 1967 paper on checkers. Whatever the number was, it is hard to find any paper either in computer science or any other academic field that has received wider attention. I am pleased that at Duke we have been able to refine search technology to the point that we can defeat Arthur Samuel's program and hope that we will continue our study of game playing program in the future."

ICCA Newsletter No. 1

. . . The first issue of International Computer Chess Association's official newsletter has appeared under the editorship of B. Mittman. The newsletter follows the organization of ICCA during the Toronto tournament, a movement spearheaded by Mr. Barend Swets of the Netherlands. Designed to encourage communications among practioners in the field of computer chess, the Newsletter is scheduled to appear several times a year and will carry items of interest to all members. To become a member and to receive the Newsletter, send $5 (annual fee) to ICCA, Vogelback Computing Center, Northwestern University, Evanston, IL 60201, USA. The Newsletter is seeking short articles, news items, letters, and other timely, informative material on computer chess. Send all editorial correspondence to ICCA Newsletter Editor at above address. The Newsletter #1 briefly discusses, among other things, the current controversy of handicapping computer programs.

Part V Chess Program

. . . In the continuation of Mike Valenti's computer chess program he discusses *Chess Position and Data Structure:*

"The basic information on which all other information is eventually gathered from a board position, is the 64 element board vector that contains codes for the type of piece on each square. The board is numbered thus (the column letters and row numbers are for external reference to the board):

Eight by Eight chess board

8	1	2	3	4	5	6	7	8
7	9	10	11	12	13	14	15	16
6	17	18	19	20	21	22	23	24
5	25	26	27	28	29	30	31	32
4	33	34	35	36	37	38	39	40
3	41	42	43	44	45	46	47	48
2	49	50	51	52	53	54	55	56
1	57	58	59	60	61	62	63	64
	A	B	C	D	E	F	G	H

WHITE

The piece codes are as follows (hexadecimal 1-byte codes)

WPM	"01"	white pawn that has moved
WPNM	"02"	white pawn that hasn't moved
WPPM	"03"	white passed pawn that has moved
WPPNM	"04"	white passed pawn that hasn't moved
WN	"05"	white knight
WB	"06"	white bishop
WRM	"07"	white rook that has moved
WRNM	"08"	white rook that hasn't moved
WQ	"09"	white queen
WKM	"0E"	white king that has moved
WKNM	"0F"	white king that hasn't moved
	"00"	no piece on the square
	"FF"	square off the board (on 12 by 12 board, see below)

The pieces are numbered as they are found on the board (left to right, top to bottom), except the kings are numbered last (king moves are evaluated last, so that the information generated for the other pieces can be used in checking for legal king moves).

The black pieces codes (BPM, BPMN, etc.) are of the form "XO" instead of "OX".

The pieces themselves are also given values according to their importance. A pawn has a value of 1, passed pawn 2, knight and bishop 3, rook 5, queen 9, and king 14. These values are used in exchange evaluation, except that the kings are not considered to be tradeable pieces.

Another board is created which is 12 by 12 and contains the 8 by 8 board internally. Special codes are placed in the off-board elements for use in the move generation routines. Thus knight moves can be checked to see if they are valid by seeing if the proposed to-squares are on the board. The 12 by 12 board is numberd thus with the piece codes for the standard starting position shown (it was later discovered that a 10 wide by 12 board is sufficient for this purpose, however there is no computation time lost and only an insignificant amount of storage is wasted).

A 64-byte conversion table is used for the frequent conversion of 8 by 8 square numbers to 12 by 12 numbers. Both boards are retained, with the 8 by 8 being the primary one. It is usually clearer to use the 8 by 8 board vec-

Twelve by Twelve chess board

	1	2	3	4	5	6	7	8	9	10	11	12
1	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
13	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
25	FF	FF	80	50	60	90	F0	60	50	80	FF	FF
37	FF	FF	20	20	20	20	20	20	20	20	FF	FF
49	FF	FF	00	00	00	00	00	00	00	00	FF	FF
61	FF	FF	00	00	00	00	00	00	00	00	FF	FF
73	FF	FF	00	00	00	00	00	00	00	00	FF	FF
85	FF	FF	00	00	00	00	00	00	00	00	FF	FF
97	FF	FF	02	02	02	02	02	02	02	02	FF	FF
109	FF	FF	08	05	06	09	0F	06	05	08	FF	FF
121	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
133	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
	133	134	135	136	137	138	139	140	141	142	143	144

tor, but it is sometimes necessary to use the 12 by 12 when worrying about the edge of the board.

In generating valid moves for all pieces except pawns, vectors are used that supply increments for searching squares out from the from-square of a piece. For instance, a vector with elements 1, -1, 8, -8, 7, -7, 9, -9, (for 8 by 8 board) and one with elements 1, -1, 12, -12, 11, -11, 13, -13 (for 12 by 12 board) are used for generating queen moves thus:

Generating Queen Moves

8 by 8 board

X-9	X-8	X-7
X-1	X	X+1
X+7	X+8	X+9

12 by 12 board

Y-13	Y-12	Y-11
Y-1	Y	Y+1
Y+11	Y+12	Y+13

Using these increments a search is made until a piece is hit or the square is off the board. If a piece is hit, the search continues to look for squares that are indirectly hit for later reference in exchange evaluations and checking for pinned pieces.

The information collected while generating legal moves is stored in the chess position data structure. This data structure is based on the one used in Ray Jones' [Jones 1971] program with additional information about pieces indirectly attacking squares. (This section continued next month.)

GØ and TELØS

. . . The following note from Bill Wickert, Computer Science Dept., University of Wisconsin, 1210 West Dayton St., Madison, WI 53706 describes the game of GØ for the uninformed and also describes a new language:

"GØ (I slash the letter) is the Oriental cultural equivalent of Chess. Two players alternate placing stones on a 19 x 19 board, each endeavoring to surround the largest area with the fewest number of stones. The rules of the game are easily learned in five to ten minutes, but mastering the game, as in chess, takes a lifetime. Computerizing the game presents several interesting problems in pattern recognition, template matching, and generalization/differentiation. Those interested in learning GØ should raid their local bookstores and libraries; those interested in computer GØ should look to Al Zobrist's work.

"TELØS is an artificial intelligence (AI) language being developed here at the U of Wis/Mad; it is PASCAL with abstract data types, coroutines, and a data base. The data base has an associative memory and other features which make incremental updating a way of life. I am a graduate student in a class which is using TELØS as a specification language, which is the immediate reason for which we are using it (we being myself, Tom Hawley, and Lou Goodman). There is more incentive beyond a grade, however. First, there are the general advantages of using a high-level language: structure, readability, modularity, etc. The incremental updating and context tree features are especially adaptable to the game-playing paradigm. More detailed information on TELØS may be obtained through Prof. Larry Travis at the above address.

"The programme we are writing will use a type (as yet undetermined) of alpha-beta-gamma pruning, advice a la Zobrist (see the January, 1973 issue of *Scientific American*), an opening book, endgame play, and the ability to accept a draw. Only a miracle would have it ready for this year's tournaments, but we do hope to enter it into competition in 1979.

"Having just received issue #2, I would like to respond to some of the letters. First, I would like to comment on the five characteristics of a utopian program proposed by Paul Copeland:

"1) Is Mr. Copeland aware of the magnitude of most move values, the rarity of there being two moves with the same value? It seems that he is suggesting that the computer play other than its best. I would agree that moves which are valued very similarly should all be possible responses, but requiring at least two? In some cases there is only one decent response besides those dictated by material loss or king safetly, such as a serious positional threat with only one counter.

"2,3) Being able to create your own starting position and inquire into the decision-making processes are imperative for debugging and testing purposes.

"4) Why should the programme against itself end in a draw? The game is still unsolved, and white does appear to have a distinct advantage.

(Continued on next page)

"5) The post-game review is a nice touch.

"For Charles F. Wilkes: have you looked into the possibility of running THE FOX on an Amdahl 470 as a solution to your speed problems?

"To Kevin McLoughlin and any other PASCAL chessters: would any of you care to swap ideas, problems, or software? I would be especially interested in seeing the data structures which you consider easily translatable to BASIC; I would sooner change ours to IBM 360 assembler than BASIC-PLUS. I would also like to hear from anyone who has a decent opening."

From Edinburgh

. . .A further report on the Edinburgh Conference on "Advances in Computer Chess" (April 10,11) is on hand from Ronald W. Mac Rae. "Two papers on static analysers were presented," he writes. "The first by J. Pitrate of Paris described a program from which a given position would produce a plan to achieve a desired goal; e.g., control of a particular square or capture of a piece. The other paper by Mr. B. Clarke described a program which for a given pawn distribution could determine if it was possible for either of the kings to achieve control of critical squares; that is, where mate can be forced or definitely prevented. The shortcomings were that the goals in the former and the critical squares in the latter had to be externally defined.

"A paper was presented by J. Moussouris (currently at the Mathematical Institute, Oxford) on CHEOPS, the *Che*ss *O*riented *P*rocessing *S*ystem developed at M.I.T. Most of the description was about the hardware: conventional CPU, I/O controllers, chess processing array, complete representation of the board and its pieces, and flag analysers. The obvious gain is in speed of computation. On the software side a description was given of an interface and a static analyser both run on CHEOPS for use by a program run on a host PDP 10.

"In the discussion at the end, only two issues were raised – both concerning funding. First, it was agreed that the computer industry be approached for support on a more formal footing. Second, it was agreed that D. Michie (of the Edinburgh Machine Intelligence Research Unit,) M.R.B. Clarke and J. Birmingham investigate and advise on the feasibility of forming a British Computer Society or a chapter of the currently formed International Computer Chess Association. A society, rather than a club, it was hoped, would attract funding for academic research.

"In the exhibition which was open to the public there were three on-line programs that could be played – *Dark Horse* by Ulf Rathsmann of Stolkholm, *Merlin* by Jeff Rollason (of a British University) and *COCMA* by A.J. Cornish of the University of Bristol. The first two programs are in FORTRAN and the last in ALGOL. Additionally, for 50 pence, you could challenge a Greenblatt program and win a pound if you won.

"I didn't play any of these as they were in high demand. But those games that I did observe showed weird play on both sides of the VDU's! There was also a continual replay of a Danny Kopec against the advice-table-based-program-end-game (king's rook vs king and knight.) On one TV they had a graphics board display of the moves, while on another they had a textual display of the advice being used by the program when it made its move; that is, the program was explaining why it made the moves that it did."

Chess Challenger Cornered

. . . Mike Molloy's 11-move game against Chess Challenger has brought the following reply from Robert T. Kurosaka, 27 Warwick Road, Watertown, MA 02172. "I have the Chess Challenger Upgraded Version (Level 3). I also have an *eight*-move game which can be played at level 1 and level 2:

White: **R.Kurosaka** Black: **Chess Challenger**

1. P-K4	P-K4
2. B-B4	N-KB3
3. Q-B3	B-B4
4. P-Q4	BxP
5. B-N5	BxNP
6. BxN	PxB
7. Q-R5	BxR ??
8. QxBP mate	

At level-3, the C.C. responds with 3. . . . Q-K2 instead. In this opening I managed to win in 24 moves. I have not tried to improve on it yet. Here are two games in which the C.C. (Black) wins in five moves:

1. P-K4	P-K4
2. N-K2	N-KB3
3. P-QR3	NxP
4. P-QN3	B-B4
5. P-QN4	BxP mate

My last move, in this 'conventional-mate' game, had to *provoke* that bishop into checking. With any non-threatening 5th move, C.C. would play NxBP, forking my queen and rook. The second game ended with a 'smothered mate.'

1. P-K4	P-K4
2. N-K2	N-KB3
3. P-KN4	NxKP
4. P-N5	NxNP
5. P-KR4	N-B6 mate

After my 3rd move, P-KN4, I feared that it would reply NxNP, but it seems to prefer the KP. After 4. P-N5, it should have played QxP but it didn't. Again my fifth move had to provoke C.C. into moving its knight. I have not found a shorter mate. I cannot induce the C.C. to checkmate me in less than five moves – so far. However, I am certain that my 'smothered mate' is the shortest of its kind. Both the above games will function at all three levels of play. Although unrated, I believe I'm a 'C' strength player. I never try for Fool's Mate, never play the 'Bishop's Opening,' never play my queen early, never play my knight to the side. There! . . . The Chess Challenger is a simple and timid player. It often overlooks a mate-in-one (yours or its). You must make non-threatening moves, else it retreates – cowering and cringing."

Shortest Known Game

. . .The classic example of the shortest short-mover in history is this well-known theoretical two-mover that has never occurred in an actual known game. It always makes good conversation when things get rather quiet in the chess room:

White	Black
1. P-KB4	P-K3
2. P-KN4	Q-R5 mate!

Wang 2200 Personal Computer

BY ALAN D. MATZGER

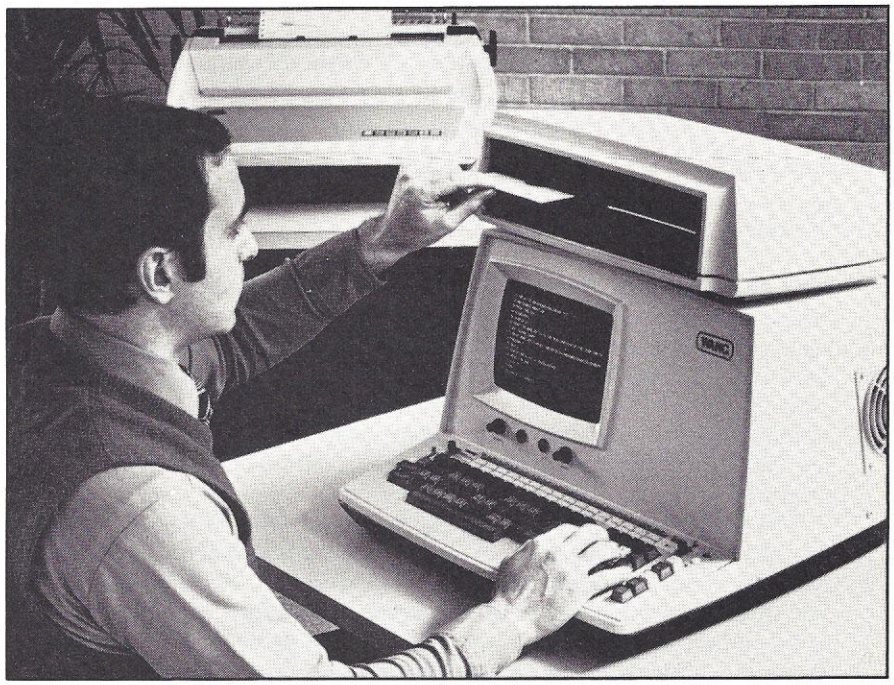
The personal computing bug infected me somewhat before the 8080, the Z-80 and the 6800 became so widely known and available. My choice back in those Dark Ages lay between IBM's 5100 and Wang's 2200 PCS, if my itch was to be scratched.

Comparing the two, I found the latter much, much more suitable for my purposes. Not only was the PCS cheaper by some $4000, but was more flexible and easier to use. Having bought it and rather readily mastered it, I felt further justified in my choice: multistatement lines, programmable screen and cursor, upper and lower case characters and a richer, fuller BASIC statement set astonishingly easy to enter and edit.

And as I read about the various micros coming on the market, I keep comparing mine to those. Sometimes it is hard to remain smug in my choice. Its disadvantages are creeping up and I delve deeper to discover more advantages. The former include the following: absolutely unique interfacing prohibits non-Wang add-ons; my old machine with its slow, single cassette drive cannot even be interfaced with Wang's own Shugart disk drives; the character generator addresses non-contiguous areas of the screen so graphics are virtually impossible.

The most discouraging aspect derives from its primary virtue: being so powerful, it seems to cut me off from personal computerists who play with the less wonderful machines. I can adapt some of *Personal Computing*'s programs for my machine, but the reverse may not be possible.

Of late, though, Wang has turned its development efforts towards compiler-based, multiprogramming hardware. Although they'll continue to service their low-end machines, they will have no use for the marvelous BASIC ROM and operating system in their new hardware. I am here to praise that interpreter, not to bury it. Maybe some day it will be available for the hobby market.



This photo shows the Wang PCS II, an upgraded version of the Wang Personal Computer System described in the text.

The interpreter resides in some 42K bytes of read-only memory. It and the operating system encroach on user RAM only 700 bytes worth, for tables and other housekeeping chores. So all of RAM, except for the fixed minimum of 700 bytes, is available for the user's program and data. And the way the interpreter was designed to encode makes that much more RAM available.

For instance, all BASIC keywords occupy just one 8-bit byte. Words like PRINTUSING, EXP and RESTORE take up just one byte in memory, even though several characters are fully displayed on the screen. Most keywords can be entered as a single keystroke, but even if they are keyed in character by character, they are still saved as one byte. The interpreter recognizes the keyword representation by context. The bit code can also represent various underlined characters: Wang uses standard ASCII encoding with HEX 80 to FF representing graphic and underlined characters (the keywords being distributed in that range as well).

How fast the interpreter executes is difficult to assess exactly. The specifications say that it adds two 13-digit numbers in 0.8 milliseconds and finds square roots in 46 of them. As far as I'm concerned, it works fast enough and it seems even faster because of the high-speed CRT driver; a long program listing goes by in a blur and a short one appears instantly.

More user time is saved by the built-in program editor. Any program line – with single or multiple statements – can be easily recalled (after the desired line number is typed in, two keystrokes put it on the screen). The cursor can be moved at will and characters may be inserted or deleted readily. In the edit mode, line numbers may also be changed, so statements can be moved around the program easily. Renumbering a whole program is done by the touch of another key and with it all its GOSUBs, GOTOs and PRINTUSINGs are appropriately changed.

The interpreter knows a hundred or so error codes. It displays the miscreant line and underneath has an arrow pointing to the approximate posi-

tion of the mistake along with the error code. Such a display can occur right after the line was keyed in or during program execution. If the program were running, it could stop and again display the offending line, together with the arrow and error code.

Program debugging is further abetted by the ability to step through a program statement by statement. Even in multi-statement lines, the currently executed line is clearly shown. With the TRACE on, each change in the value of a variable is shown and every branch from line number sequence is shown as well. By slowing down the screen to nine-sixths of a second (plenty long enough), the TRACEd values and branchings can be followed without the executed line being shown. PRINT and HEXPRINT work without line numbers so that values of numeric or alpha variables can be displayed whenever wanted.

The Wang does decimal arithmetic internally and all numbers are stored in 8 bytes as signed floaters with 13-digit mantissas. The range of values can stretch from plus or minus 10^{99} to plus or minus 10^{-99}. Numbers beyond the range 10^{-1} to 10^{13} are displayed in "E-notation" automatically.

Besides usual arithmetic functions, other operations include trig functions with their inverses. A 13-digit pi is resident and usable at a single keystroke. (Trig functions operate on degrees, radians or gradians.) And there is a ful range of matrix manipulating statements including inversion, determinan finding and transposition.

Up to 286 different numeric variables are allowed, from A to Z and A0 to Z9. Furthermore, arrays may have the same names without confusing things. Alphanumeric variables similarly can number 286 and so may one- or two-dimensional arrays of them. De fault length for an alpha variable or array element is 16 characters, but a DIM or COM statement can reduce it to one or extend it to 64. The STR function can operate on designated substrings of variables and array elements.

Another space-saving technique is conversion of numbers into alpha variables, substrings and arrays. Intege up to 255 can be crammed into one byte and two characters can represent values up to 2^{17}-1. Signed real numbers of 2n-1 digits can be packed into n characters. When matrix arithmetic is not required for large sets of numbers, the numbers may be stored in core, on disk or tape as character arrays, thus saving much space. Conversion back and forth is done via CONVERT, VAL, BIN, $PACK and $UNPACK statements. By these techniques numeric arrays of more than two dimensions can be saved; x, y and z coordinates become certain substrings of a character variable.

A full range of logical operations may be performed on the bits in a single byte and on corresponding byte of two alpha variables. I've not yet dis covered many uses for these functions but they're there. Unfortunately, strings of logical operations on numbers and strings (as in IF F=C AND E$=H$ OR . . . THEN . . .) are not readily available, but subroutines are easily designed to get around this limitation.

Besides calling subroutines by line number, Wang BASIC allows calling

Wang Replies:

First, in regard to Dr. Matzger's statement about Wang turning development efforts toward compiler-based miltiprogramming hardware: Wang is constantly improving and extending its product line, and part of that expansion has brought us into multiprogramming, multiprocessing systems. The latest effort in this area is our 2200 VS virtual system which gives each of up to 23 workstations the equivalent of one million bytes user memory. Additionally, our 2200VP CPU *delivers multiprocessing capabilities in our non-virtual product line.*

However, in both of these products, Wang's commercial BASIC *is available and widely used. Granted, in these systems it is loaded rather than hardwired, but both are highly compatible with our* BASIC ROM *systems. So yes, we have turned a portion of our development efforts toward compiler-based multiprogramming hardware. However, we are not neglecting the* BASIC ROM *user group and hardwired compilers which have for so many years been our mainstay. This is merely an expansion, not the end of an era.*

As far as having no use for the marvelous BASIC ROM, *the majority of Wang's programs use* BASIC ROM *and will continue to do so far as I can see into the future. Granted, our new virtual system uses* BASIC *along with* COBOL *and* RPGII, *as well as an assembler language. But that is merely one end of our product line. We are still actively marketing minicomputers with 8K user memory and a single minidiskette drive for under $5,000.*

Addressing "not understanding between Wang CPU *and others' peripherals", all I can say is Wang can't be all things to all people. Certainly a number of peripheral manufacturers have made fortunes building* IBM *plug-compatible peripherals. However, when you get into the hobbyist market, such a strategy does not become practical or profitable. I have witnessed Wang* CPUs *connected to everything from Texas Instrument plotters to laser blood analyzers.*

Naturally, Wang would prefer to see its CPUs *connected to its own peripherals. However, utilizing the proper interface or minor reprogramming has often resulted in the successful marriage of Wang and foreign peripherals.*

Finally, "Is the Wang interpreter going to be made available to the hobbyist?" At this time Wand does not intend to direct its efforts directly towards the hobbyist markets. We have been highly successful in the business and scientific communities and, for the most part, will continue to direct our efforts in those areas.

Obviously, the home computer is just on the horizon. However, the current marketplace is confused and trying to support as many applications as there are users.

This is not to detract from the hobbyist market in the least. Major innovations and developments will come directly from the hobbyist. Therefore, creating a special line of peripherals exclusively to be marketed to them, would not only be impracticable at this time, it would probably take most of the fun out of what these people are trying to accomplish. – Adam W. Couture, Advertising Manager

by "name" – a number between 0 and 255. By this latter method, variables, constants and literals may be passed to the subroutine. Care must be exercised because all variables are global; changing a value in a subroutine changes it for the parent program too. Values may be passed among chained programs by labeling values as COMmon and if no longer needed they can be erased from memory by COM CLEAR.

The Wang keyboard looks like an ordinary typewriter with a number and arithmetic function pad to the right. Across the top are 16 special function keys which turn into 32 when the shift key is pressed. Each can be defined for use in a program by assigning a subroutine "name" between 0 and 31 to it. Additionally, they represent characters from HEX 00 to 1F; the KEYIN statement acts on the character in the one-byte input buffer, branches to one statement if it is less than HEX 20 and goes to another if greater.

Included in the same interpreter is a powerful set of SORTing and MERGEing utilities which construct locator arrays and then move these array elements hither and thither based on these pointers. Parts or all of alpha arrays can be searched quickly and found elements "filed" into the locator array. Sort-merge operations take a lot of memory, but not very much time.

Finally, there are the statements which control the various I/O devices – CRT, keyboard, tape and disk drives, plotters, printers, digitizers, card and paper tape readers and telecommunications interfaces. The simpler of these statements are understood right now only by Wang-built peripherals; however, special $GIO statements can tailor I/O operations in microcode. Nevertheless, this non-understanding between Wang's CPU and others' peripherals is a major drawback.

So, if the Wang interpreter is ever available for the hobbyist, some earnest tinkering with its I/O codes will be necessary to make it compatible with other devices. The marketer may, like the Wang people, demand a special line of peripherals. It would further fragment an already fragmented market and add to the general confusion. I believe, nonetheless, that the interpreter is powerful enough and useful enough to warrant the added confusion. □

KEA GraphicAdd

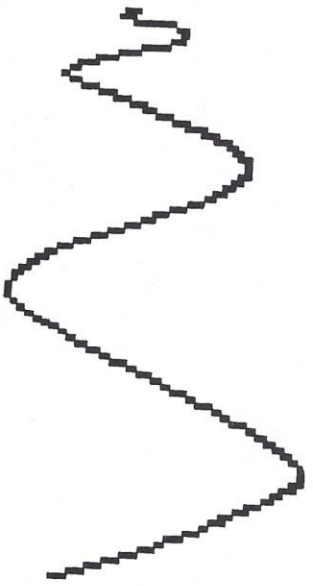
BY HOWARD JOHNSON AND STEVE JOHNSON

Being "spoiled" users of full graphics on a Tektronix 4010/PDP-10, we've had more than a passing interest in implementing high-res graphics on our Sol. Well aware of typical costs and memory burdens of such capabilities and having heard favorable comments about the $50 GraphicAdd, we eagerly placed an order for one of these with our friendly local computer store in December. It finally arrived in early April, and we had it running two days later! Since neither of us could be classed as experienced electronics types, that in itself speaks well for the product.

Construction is easy and rapid – a leisurely evening project. The PC board is excellent quality and clearly marked. Soldered components include four capacitors, two (or three) resistors, and seven DIP sockets in addition to twenty-three terminal pins that allow the board to plug into the Sol (or VDM). Proper installation of these pins is the most difficult part of construction. The method of alignment recommended by KEA works quite well, however. In general, instructions supplied with the kit were adequate – complete with PC layout and schematic.

Installation of the device is more difficult because the safest way to implement the necessary mods to the Sol PC board is by jumper wire on the solder side. This requires disassembly of the Sol. We used #1 and #2 – 2 options (3 jumpers and a trace cut) that allow

GraphicAdd Program



```
010 PRINT CHR$(11)
020 INPUT "Graph Height (3,5,7)?.
030 A=CALL(51968)  (Clear Screen)
040 A=CALL(52146)  (Enable graphics)
050 W=1
060 T=100
070 L=21.5
080 S=0.05
090 FOR Z=1 TO L STEP S
100 X=W*(1+Z/T*Z^2)/100
110 Y=H*(1+Z/T*COS(Z))/2
120 A=256*INT(47*Y+.5)+INT(127*X+.5)
130 B=CALL(51982,A) (Call graphics)
140 NEXT
150 B=CALL(52139)   (Wait for input)
160 END
```

Here's a nifty little program that'll begin to familiarize you with GraphicAdd. Modifying specific lines from 050 to 120 will give you an expansive array of design possibilities. Follow the little brick road . . . .

PRODUCT CLOSE-UP

programmable graphics enable (as opposed to fixed graphics or switch-selectable enable). Mod #1 is necessary for all options as it provides access to data bit 8 of the video display memory. After these mods, there was no apparent effect on the normal operation of the Sol with GraphicAdd installed or removed. Again, the supplied instructions (with alternate instructions for the Proc. Tech. VDM board) were entirely adequate – complete with Sol PC (and VDM) mod diagrams and modified schematics.

GraphicAdd comes with five ICs; the two additional ICs come from the Sol and plug into the remaining two DIP sockets. The "piggy back" board then plugs into the two DIP sockets on the Sol PC left vacant by the two-chip transfer. On the Sol PC this plug-in area is comprised of the sockets labeled U41 and U25 (under the front left of the keyboard). To prevent the keyboard from exerting undue pressure on the "piggy back" board, we used the recommended standoffs (2 washers under each mounting screw) to elevate the keyboard slightly. This worked well, but we would have preferred something like two fiber plates with properly placed holes and a sticky backing. This would permit convenient future removal and re-installation of the keyboard as well as providing better support (manipulating 8 fiber washers in addition to 4 lock washers is clumsy to say the least).

GraphicAdd provides a modest, but useful expansion of capabilities of character generation of the VDM display section. It functions by replacing a portion of the inverse video ASCII character set by bit-mapped graphic cells. In effect, it provides a 6-fold increase in graphics resolution (128H x 48V) because the normal 9 by 13 dot pattern is divided into six independent portions. Vertically, each character matrix is divided in half; horizontally, the 13 dot column is divided 4, 5, 4. Thus "minicursors" are made up of either a 4 x 5 or 5 x 5 dot pattern. The resulting 20% difference in cell heights, depending upon scan location, is not a major objection in our judgement. Regarding vertical division "in half," the logic is such that two adjacent minicursors will add up to nine dots horizontally rather than ten.

Only a limited amount of software came with our kit; however, this provided a good general indication of capabilities. The graphics version of "Life" provided on cassette is a rather intriguing variation and permits one to "draw" interesting patterns with increased resolution. A BASIC5 graphics implementation, also provided on cassette, is included at the end of BASIC5. It adds a 0.75K extension with self-patching. A cassette program called EXONE demonstrates graph plotting capabilities with BASIC5. In general, diagonals and curves are plotted neatly as solid lines – though, obviously, "stepping" remains prominent at this resolution.

A separate graphics driver routine, provided on cassette, allows interfacing to various Basic interpreters. It loads in the Sol scratchpad RAM (CB00H) and allows simultaneous display of graphics and normal ASCII characters. We were able to use the driver rather easily with North Star BASIC via the machine language subroutine CALL function. Expressions that set up the x,y coordinates for passing to the D and E registers are used as the argument for the CALL to the graphics driver routine. Thus we were able to easily implement "Spiral" (provided as a program listing for BASIC5) in North Star BASIC and save it and the driver on diskette. As an example, the curve shown in Figure One was plotted by a simple program (listing appended) written in North Star BASIC version 6, release 3. Similarly, various functions can be plotted more conveniently by simple modifications of KEA's exemplary EXONE program using the extended BASIC5 (linear, parabolic and trigonometric functions, for example). Reportedly, similar software patch extensions for North Star BASIC and Processor Technology Extended Cassette BASIC are under development.

GraphicAdd is a product of KEA Micro Design of Toronto, Ontario, Canada. It is supplied as a kit consisting of a small PC board and all necessary components with a 29 page manual and cassette tape. It is intended for the Sol and other systems using the Processor Technology VDM board and with as little as 8K of memory. In our estimation, GraphicAdd is a worthwhile accessory for modest, but useful, expansion of Sol/VDM graphics capabilities at very reasonable cost. □

High Level Languages

Mupro Systems Division has added **BASIC** language capability to its **MUTE** Multi-User Disk System. The system supports multiple concurrent BASIC users. BASIC is implemented as an interpreter. It provides general computational capability for the Mupro disk system user.

The Multi-User/Multi-Task Executive (MUTE) Disk System is a standard feature of the Mupro-80DOS disk based microprocessor hardware/software development system along with a fully relocatable 8080/8085 mnemonic assembler, the higher level BSAL-80/85 programming language, relocating/linking loader, text editor and debug package. This disk based development system is the only system of its kind which is capable of supporting three concurrent users as well as providing batch processing. The MUTE Executive has also been enthusiastically received by OEMs who are currently using it as the basis of their microcomputer system software.

The addition of BASIC broadens the application of the system. BASIC provides an easy to learn, easy to use programming tool. As implemented by Mupro, BASIC offers general computational and string handling capability. Programs may be input via paper tape or keyboard, stored on user diskettes or paper tape, and listed on a terminal or line printer.

BASIC operates on any Mupro disk system with MUTE release 2.1. It is available to current customers for $75.00. It is standard equipment in all Mupro-80DOS Disk Systems shipped after May 31, 1978.

For more information, contact Mupro, 424 Oakmead Parkway, Sunnyvale, CA 94086; (408) 737-0500. Circle No. 103.

The Heurikon Corporation announces the addition of **HEURIKON BASIC & DOS** to its line of MLZ-80 microcomputer products.

HEURIKON BASIC & DOS is a multi-level system offering two levels of concurrent operation and a disk operating system with particularly efficient file management. The system provides both "Edit" and "Realtime" program areas which run concurrently. Realtime programs run independently from the keyboard and program editing functions. A realtime program is given highest operating priority and may be started automatically in response to external stimuli. Edit area programs will be interrupted to service realtime operations. When the realtime program completes a task, control is returned to the interrupted point in the edit program. New programs may be developed and tested in Edit while the realtime program continues to monitor external events.

A particularly beneficial feature of HEURIKON BASIC & DOS file management architecture is that it allows any number of variable length files to be cataloged on the diskette. As files are created or modified, additional sectors are attached to the end of the file as required. When sectors become available (for instance, after purging a file) they are returned to the available space pool. This scheme provides maximum utilization of the diskette area.

This system is available configured to run the Heurikon MLZ-80 microcomputer system. The MLZ-80 is fully compatible with Intel's SBC Multibus. HEURIKON BASIC & DOS can be provided on diskette or in EPROM. Contact factory for details.

For HEURIKON BASIC & DOS system summary please contact Chris Priebe, Heurikon Corporation, 700 W. Badger Rd., Madison, WI 53713; (608) 255-9075. Circle No. 102.

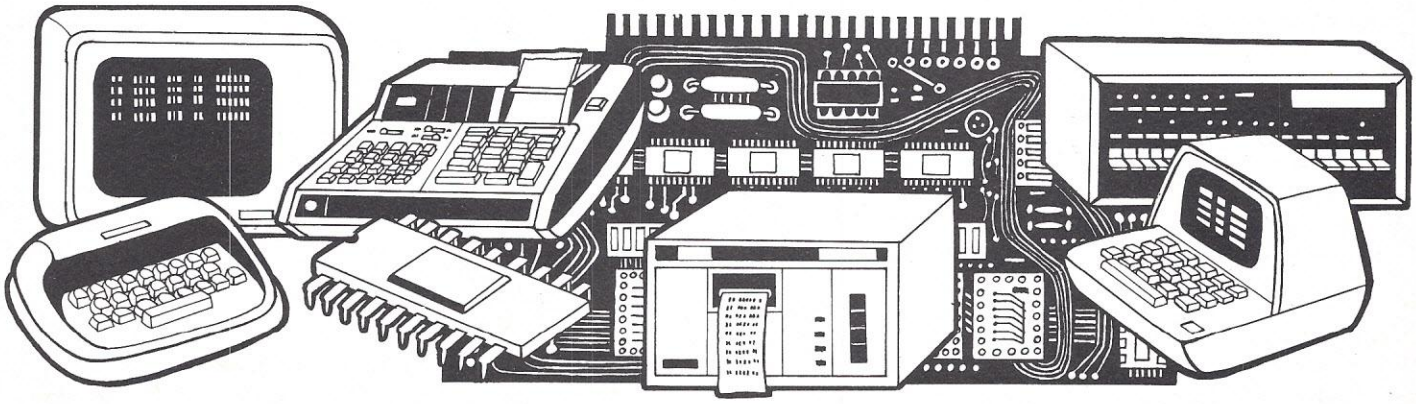
Micro Business Systems, Inc., announces the first full BASIC interpreter for use with Fairchild's F8 microprocessor. Called **MBS-BASIC**, the new product features 9-digit precision and floating point arithmetic.

Including all standard arithmetic operations and relations, MBS-BASIC is competitive in speed and efficiency with the 8080 and Z80 BASIC interpreters. Charles X. Grady, director of marketing for MBS, stated "the increased accuracy of MBS-BASIC is due to the 9-digit floating point precision." He noted that most microprocessor-compatible BASIC interpreters have limited, 6-digit precision.

According to Grady, "the advantages and excellent features of Fairchild's F8 probably have been under-utilized because of the lack of a readily available higher level language.

"We expect MBS-BASIC to open the hobby market for the F8," Grady added. "It's our contention that the F8 microprocessor hasn't been as popular with the hobbyists because a majority of that group don't want to program in machine language," he said.

Available for immediate delivery,



MBS-BASIC version 1.0 has a license fee of $179.95. The MBS-BASIC interpreter is distributed on ASR33-compatible paper tape and is provided with documentation.

Micro Business Systems, a developer of custom microprocessor software systems may be contacted for further information by writing Box 8255, JFK Station, Boston, MA 02114; (617) 682-1854. Circle No. 118.

A dialect of the high-level language BASIC, designated as **POWER BASIC**, has been introduced by Texas Instruments along with three members of the new POWER BASIC family of language interpreters. The new language and interpreters are designed to help solve industrial control problems using the 990/9900 family of microcomputers, microprocessors and minicomputers.

The TM990/450 is the evaluation family member. With 8K bytes of memory, the TM990/450 is designed to offer stand-alone evaluation tools for exploring POWER BASIC applications. It is available as a ROM device kit or on a version of the TM990/101 microcomputer board.

The TM990/451 is a development POWER BASIC interpreter with 12K bytes of memory providing the capability for design, development, debug and EPROM programming of POWER BASIC programs.

The TMSW201F configurable POWER BASIC interpreter is a fully expanded version including complete floppy diskette file support and an automatic configuration program which reduces the size of POWER BASIC programs for production execution.

Originally developed to extend the computation power of large computers, BASIC has been applied to a broad spectrum of problems with high efficiency as well as ease of use. Simplicity and ease of interaction are two factors which account for much of BASIC's appeal.

POWER BASIC is an extention of the original language that offers a very fast, efficient higher level software language developed to execute in various operating environments. It can be used for general system implementation language as well as for information processing. It is also versatile enough to solve problems in real-time control of events while improving programmer efficiency in implementing complex algorithms.

The TM990/450 and TM990/451 are $375 and $500 each respectively as ROM device kits. The TM990/450 software will also be available on the TM990/101M-10 microcomputer board for $885 each. The TMSW201F is $500 each. For more information, contact Texas Instruments Incorporated, P.O. Box 1443, M/S 653 (Attn: PBASIC), Houston, TX 77001. Circle No. 117.

Zilog, Inc., has announced it is supporting its MCZ-1 Series of microcomputers with **COBOL** , the business programming language.

Zilog's version of the 1974 ANSI X3.23 COBOL is designed specifically for the microcomputer environment and incorporates many "Level 2" features to ful whenever the package's fundamental speed and size are important.

Users of Zilog's MCZ microcomputer systems can compile and execute standard COBOL programs with performance and features that equal or exceed COBOL performance on some of the most widely used minicomputers, according to Bob Marsh, manager of Zilog's Information Systems group.

Such extended CRT control features as "accept" and "display" make interactive programming easier and make Zilog's COBOL especially well suited to data-entry applications.

Other Zilog-COBOL features include: A debug structure needing no special compilation that provides interactive microcomputer program development; sequential file access; indexed file access; random files; program segmentation; library; interprogram communication; and 18-digit decimal and binary data types.

Designed to allow relatively large programs in a small machine, Zilog's COBOL runs on 48K-byte MCZ systems. The language uses Zilog's Disk Operating System (ZDOS II) and it runs under the standard RIO Operating System.

Zilog's COBOL is provided with full documentation, including two manuals: (1) a "User's Guide" explaining how to compile programs and how to interface with RIO and (2) a "Reference Manual" describing the syntax of the language and implementation details.

The spectrum of applications for COBOL includes banking and savings, government, health care, insurance, manufacturing, public utilities, merchandising and distribution.

Zilog, an affiliate of Exxon Enterprises, manufactures and markets microcomputer circuits, boards and complete systems; associated software; and memory devices.

For more information, contact Bob Marsh, Zilog, 10340 Bubb Road, Cupertino, CA 95014; (408) 446-4666. Circle No. 119.

Micro Focus Ltd., the London-based microcomputer systems and software house, has launched its CIS COBOL Compiler for the Intel 8080 on the US market.

CIS (Compact Interactive Standard) COBOL was designed by Micro Focus for the micro, small business systems and terminal user markets, and it is aimed especially at those users who want to develop their own programs directly on their own machines.

The first implementation of CIS COBOL was on ICL's 1500 Transaction System, and an Intel 8080 version is now available.

Specific system implementations for 8080 CIS COBOL have already been ordered by Tandberg of Norway for their TDV range of intelligent desktop terminals and by R2E, the French microcomputer firm, for their Micral range.

In addition, Micro Focus has underlined the universal appeal of CIS COBOL by implementing it for the CP/M operating system which opens far wider opportunities for the product on a host of other systems. An MDS-800 version is also now available "off the shelf" directly from Micro Focus.

Xitan is currently exploring with Micro Focus yet another implementation for CIS COBOL on Xitan's recently announced "General" microcomputer systems now under development.

"We now have a number of 8080 implementations under our belts, but these have been achieved in advance of our main marketing drive," says Micro Focus managing director Paul O'Grady. "We are confident that this (US) market place will appreciate the way in which we have tailored CIS COBOL for the micro environment."

Both the MDS-800 and CP/M versions are being sold directly to end-users. "Although we will continue to complement this with OEM deals."

Micro Focus is an independent British software house which was set

up in 1976 to develop software for the new generation of systems.

Micro Focus has taken COBOL – traditionally a batch processing language – and extended it to provide those extra facilities which the micro user needs.

CIS COBOL extensions include advanced data entry facilities, run time input of filenames, line sequential files, hexadecimal literals, rapid development facilities, lower case, interactive debugging and easy option.

CIS COBOL compiles each COBOL source statement to a compact intermediate code which is then interpreted by a Run Time System.

For the user who wishes to retain compatibility with his mainframe, there is in addition an ANSI '74 Compatibility Option. This is a compile time switch which instructs the Compiler to accept only standard ANSI '74 statements.

Particularly significant are the advanced data entry facilities. The user can format the screen of any teletype compatible CRT into protected and unprotected fields by using standard COBOL statements. The screen layout is defined in the DATA DIVISION.

An ACCEPT nominates a record description which permits input to the character positions corresponding to variables identified by data-names. These may be separated by FILLERs to position them on the screen.

Conversely, a DISPLAY will output only from non-FILLER fields in the record description which it nominates. The programmer can easily build up complex conversations for data entry and transaction processing.

While the data is being keyed in, the operator has full cursor manipulation facilities, each variable acting as a tab stop.

The program development cycle is simplicity itself. The programmer uses his own existing Editor to provide a source file for the Compiler. Just one command loads the single pass Compiler to convert the source program into an interpreted object form known as intermediate code. If the program has compiled cleanly, one more simple command loads the Run Time System, which in turn loads the application program automatically.

The programmer now has available the powerful CIS COBOL Interactive Debugging Facility. This allows the user to insert breakpoints, examine and modify store and so forth, and then continue program execution.

If there are compilation errors, the programmer may correct those on the list file itself using his own Editor and then resubmit this corrected file as a source file to the Compiler.

Those who are starting on COBOL can omit most of its "red tape" statements which are required in the orthodox batch situation, but are not necessary to run programs on a microcomputer.

For further information, contact Paul O'Grady/Brian Reynolds, Micro Focus Ltd., 18 Vernon Yard, Portobello Road, London W11 2DX; Telephone: 01-727 5814. Circle No. 112.

Continued on next page

Application Programs

HSC Computer Services, Ltd., announces the development of the **Cash Disbursements Program**. The package written in North Star BASIC allows: (1) Storage on disk of date, Check no., and amount; (2) Instant recall of data stored for any month with display; (3) Totals of up to 20 columns of figures; (4) Calculation of Federal Tax Deposit to be made each month based on FICA and Federal Tax witholdings; (5) Check if disbursements are in balance, with message if in balance or not and amounts for left and right sides; (6) Entry of data is specified by line and column no. for ease of reference; and (7)When data is stored on disk by itself (after loading program in RAM) a program will be supplied for a nominal charge that will give a grand total for all 20 columns of data for the past year.

Price of the Cash Disbursements Program is $25. New York City residents please add 8% sales tax. The program is supplied on diskette with users manual. For more information, contact HSC Computer Services, Ltd., PO Box 43, Brooklyn, NY 11236; (212) 642-6912. Circle No. 114.

A new **microcomputer pharmacy system** which results in savings in medication charges and improved safety for patients in small hospitals was developed and is being marketed by Medical Inter-Act Systems Corporation of Fort Lauderdale, Florida.

The new micro pharmacy system, designed to be cost effective in the pharmacies of hospitals ranging from 25 to 150 beds, is configured around an LSI microcomputer according to Darryl D. Zellers, President of MISC . Pharmacy systems which utilize minicomputers are presently being marketed by MISC to hospitals ranging from 150 to 3000 beds in size.

Zellers explained that the present systems which have been in use for several years in larger hospitals cannot be cost justified in the small hospitals. The new micro pharmacy system, which can be leased for under $1,000 per month, offers the benefits of the larger systems in the small hospital. The systems have been shown to reduce patient care costs while improving the safety of the use of medications in hospitals.

The MISC Pharmacy Systems control drugs and intravenous solutions from the time a physician writes an order until the order is discontinued or the patient is discharged. The system also checks all orders against drugs a patient is allergic to and for drugs which might interact adversely with each other. This prevents a patient from receiving drugs which could cause an adverse effect and thus prolong hospitalization. Other functions of the system include scheduling drugs to be administered, keeping an accurate record of doses actually administered, charging only for those drugs that the patient receives and controlling the pharmacy inventory.

For more information, contact Medical Inter-Act Systems Corp., 2501 East Commercial Blvd., Ste. 205, Fort Lauderdale, FL 33308; (305) 491-3885. Circle No. 105.

Planning and forecasting are key phases in any business project. The more accurately an operation can be planned and the necessary components organized, the more likely it will be a success. Two new application software packages are now available from Hewlett-Packard Company that describe how to increase the effectiveness of the HP 9845 desktop computer for planning activities in project management, forecasting and graphics.

The HP 9845 with HP **Forecasting and Graphics software (Part #09845-10510)** is capable of analyzing and smoothing raw data to determine trends, seasonality and random variations. With this software, the computer can produce both graphical and numeric data using any of five different forecast methods for applications such as sales forecasting, performance analysis and cost projections. Time series data can be quickly analyzed and smoothed through several statistical techniques such as finite differences, trend removal, seasonal corrections, moving averages and exponential smoothing. Also, bar graphs and pie charts can be quickly produced for uses such as management reports and presentations. Price of the software package is $300 (U.S. price only).

The $500 HP 9845 **Project Management software (Part #09845-1 1000)** uses network analysis techniques (CPM, PERT, MPM) to aid in formulating basic plans, allocating key resources, anticipating problem areas and evaluating alternate planning decisions. Included in the application summary are the highlights of the many program features – network techniques, project capacity, subnetworking, multiple sort keys, probability calculations, and multi-character descriptions and others. Sample printouts illustrate the six program modules – data input and update, correction listing, network initialization, sorting and reports. Hardware configuration and ordering information also are included. For more information, contact Inquiries Manager, Hewlett-Packard Company, 1507 Page Mill Road, Palo Alto, CA 94304; (415) 856-1501. Circle No. 125.

National Semiconductor Corporation announced an upgrade to its Datachecker POS system to effectively manage supermarket labor scheduling and reporting.

The new package, called **Labor Management Program (LMP)**, uses data collected by a store's Datachecker POS system to forecast business for the next week, then schedule labor by department to meet the needs of the expected business.

Every store does labor scheduling; it is the method that makes the difference between profit and loss. The Datachecker labor management system refines traditional scheduling methods and is designed to overcome these serious obstacles to effective labor management:

- The wide variation in checker productivity;
- Baggers' effect on the productivity of checkers;
- Tedious scheduling that takes these factors into consideration;
- Conventional records that cannot tell management whether the store manager's schedule really results in the desired customer service level.

Basically, the Labor Scheduling system takes a sales forecast prepared by the store manager and generates manpower requirements (by the hour). It then monitors performance of each employee and of the manager's actual labor use. The system relieves the store manager of the burden of logging hourly register readings, monitoring checker performance and calculating manpower requirements.

A store manager can start now with

front end scheduling (checkers and baggers) and then add all other employees at a later time. Although the system is available for host support through communications, its real value is in in-store operation.

Time and Attendance complements Labor Scheduling and makes a complete system. T & A eliminates the need for time cards and all related key punch and data handling usually required for control and payroll. Using only a badge reader, Datachecker monitors labor hours actually used, compares to forecast and issues reports showing performances. As an option, the system can also read results directly to a host computer payroll program for direct issuance of pay checks.

The Labor Management Program effectively meets the challenge of front-end scheduling – one of the most difficult areas to schedule – and one of the most important, typically accounting for 25% of labor costs and 75% of employees, according to Fred Bialek, vice president and general manager of National Semiconductor's Systems Division. With electronic POS, employees become more productive.

The labor management system provides the store manager with a "Daily Forecast" (in dollars or items sold). Then it breaks this down by time of day into a "Detailed Forecast." Based on this profile, checker and bagger requirements are forecast and reported. A Checker/Bagger Effectiveness report measures each individual's performance.

The store manager prepares his labor schedule from the Checker Effectiveness and Checker Requirements reports, taking into account employee contractual requirements and management policies. The resulting schedule will make far more efficient use of labor time, far exceeding results from manual scheduling methods, according to Bialek.

The Labor Management system provides exception reports that identify employee productivity, the accuracy of the forecasts, and the resulting service level.

A National Semiconductor Datachecker representative can provide further details on availability and pricing. For more information, contact National Semiconductor, 2900 Semiconductor Drive, Santa Clara, CA 95051; (408) 737-5000. Circle No. 122.

A unique new inventory management system known as the AIM System and written by Computer Mart of New Jersey's software staff is now in its second revision. The AIM System is **a comprehensive inventory management system** that includes on-line inventory maintenance, purchase order, sales order, sales order entry, backorder release and reporting functions for all small businesses. The system is based upon MICROPOLIS BASIC for 8080 systems, utilizing Micropolis Disk Drives.

The AIM System was developed and implemented by experts in business applications with the intention of supplying a microprocessor based system which could properly function within the demanding constraints of the business environment.

"In order to accomplish this goal,

our systems' designers were faced with the task of implementing an ISAM file structure (indexed sequential access method), which could support multiple logical records per sector, some records having different record formats, with the insistence that the system design be completely transparent to the users," commented Eri Golembo, Vice President of The Computer Mart of New Jersey.

It is in this respect that the AIM System is unique. Furthermore, besides providing the business user with the flexibility he has grown accustomed to in larger system designs, the AIM System represents a powerful learning tool for programmers and analysts who wish to fully utilize the capacity of a disk drive without sacrificing ease of operation by the user.

AIM System handles 1000 inventory items, 4000 purchase order line items (up to 9 per PO), sales order entry, automatic release of backorders, maintenance of sales history, maintenance of vendors, and various reporting functions. This capacity can be increased to the full extent of the disk drives.

The software and manual is being distributed to end users for $100 each.

Dealers are finding it an excellent package for displaying the versatility of the Micropolis drives. (Special dealer arrangements are available.) For more information, contact Computer Mart of New Jersey, 501 Route 27, Iselin, NJ; (201) 283-0600. Circle No. 126

Text Editors

Aox Associates announces MATE, a **powerful, screen-oriented text editor for 8080 or Z-80** microcomputers with floppy disks running under ICOM or TDL FDOS. MATE expands upon the capabilities of other text editors, while simplifying user interaction, by dividing the screen into text display and command string sections. TECO-like command strings use iteration, conditional branching, and macros to operate on 10 dynamically allocated buffers.

The independent text section of the screen instantly reflects any changes in the edit buffer, with text moving up and down, right and left, as commands modify the buffer. In another mode, keystrokes are directly entered on the screen and in the text. MATE can be used not only with a VDM-1, or similar video display board, but fast screen updates can also be obtained with a CRT terminal such as a Lear Siegler "Dumb Terminal", because extensive display driver software utilizes the addressable cursor to make only necessary changes.

A wide variety of character, word, line and paragraph oriented commands are entered in the separately scrolling command section of the display. Command strings can range in complexity from a single character through full text editing programs – complete with variables, numerical calculations, conditional jumps, and comments – and can be freely formatted with spaces, tabs and carriage returns for clarity. A command string may be executed as a macro by storing it in one of the 10 buffers, saving it on the disk or incorporating it as a permanent part of MATE. Macros can be nested and receive string arguments from the calling command. Word processing facilities include an automatic line width formatting feature for both screen display and output printing, upper and lower case and settable tab stops and margins.

MATE is available on 8" diskette for $49.50, including 9K bytes of object code for the editor, and object and source code for several popular screen, keyboard and printer drivers. The comprehensive user and interface manual (which can be purchased separately for $5.00, refundable with complete order), gives instructions to help easily adapt these drivers to other hardware. For further information, contact Michael Aronson at Aox Associates, P.O. Box 558, Somerville, MA 02143. Circle No. 111.

TSC is now distributing software compatible with the FLEX operating system found on Southwest Technical Products Corporation MF-68 minifloppy and DMAF-1 full sized floppy disk systems. A disk version of TSC's popular **Text Editing System** is available for $31.50 for the mini (SL68-24D) or $50.00 for the full sized (SL68-24F). These allow disk-to-disk editing of named files which means you can edit a file as large as the disk space. A minifloppy version of the **TSC Mnemonic Assembler** sells for $31.50 (SL68-26D) and a full sized version for $50.00 (SL68-26F). Assembly may be performed directly to disk.

Finally, the TSC **Text Processing System** is available for the mini at a cost of $40.00 (SL68-29D) or for the full sized floppy at $75.00 (SL68-29F). Text processing is performed on named files with the ability to process multiple files from one command. A macro library file may be automatically loaded on initialization. A separate data file may be read by the Text Processor. For example, a name and address file can be merged with a standard letter to print form letters without operator intervention. Contact Technical Systems Consultants, Inc., Box 2574, West Lafayette, IN 47906; (317) 423-5465. Circle No. 108.

Technical Systems Consultants, Inc. has announced availability of it **8080 Text Processing System** which allows the use of over 50 commands for special text formatting applications. The commands included will support multiple spacing, left margin control, indenting, the ability to save contiguous text, paging, left hand justification, right hand only justification, left and right justification, centering, no-fill modes, page numbering, the printing of left, right or centered titles, and line length control.

Also included are capabilities for macro definition to define and build special formatting commands, number registers which can be used like variables in a program, conditional command execution, setable macro execution points (to execute a macro at a predefined line number), the ability to prompt a terminal for text during the formatting process and a feature which allows sending informative strings to the terminal.

The TSC 8080 Text Processing System will also output numbers in either Arabic, capital Roman numerals or small Roman numerals. Tab columns may be defined as well as the tab character and tab fill character. Environment switching is permitted for easy parameter changing and a loop command is available for repeated formatting jobs such as form letters.

An external editor is required as no editing functions are included. The TSC Text Processor resides in just over 8K beginning at 1000 hex plus filespace.

$32.00 buys the full manual including an "Introduction to Text Processing", user's guide, and fully commented assembled source listing. An Intel ASCII format paper tape is avail-

able for an additional $9.00. Contact Technical Systems Consultants, Inc., Box 2574, West Lafayette, IN 47906; (317) 423-4565. Circle No. 109.

Assemblers Debuggers Disassemblers

Microtec has added a **Meta Assembler for the 2900 Bit Slice microprocessor** to its line of microprocessor support software. The Meta Assembler language is compatible with Advanced Micro Devices' (AMD's) AMDASM language, but is written in ANSI standard FORTRAN IV and will run on any computer that has a word length greater than or equal to 16 bits. This includes most minicomputers.

A microprogrammable bit slice microprocessor differs from an ordinary microprocessor in that the user can define the instruction set and hardware configuration. The Meta Assembler allows a user to define an instruction set and then assemble programs utilizing that instruction set. The Assembly program features conditional assembly, complex expression evaluation, and a cross reference table listing.

A separate program in the Meta Assembler Package is used to break up the assembled object code into organizations that are compatible with the target PROM or ROM array. Additionally, the object module format is translated into either BNPF or Data I/O's ASCII hexadecimal format.

For more information, contact Microtec, P.O. Box 60337, Sunnyvale, CA. 94088; (408) 733-2919. Circle No. 124.

Pacesetter Corporation's TRACE, a **program for program debugging**, gives Datapoint Datashare application programmers insights into the actual logic paths taken by their programs, while they are executing, according to developers. Actual labels of the steps executed can be displayed on the terminal, written to disk for later examination or routed to the printer. Knowing exactly what the program being tested is doing allows the programmer to compare what is happening to what should be happening, and fix it.

TRACE asks the programmer several questions. Depending upon the answers, the program generates a new source code program with coding inserted to perform the option selected. The new source code is then compiled and tested; the original program remains unchanged.

TRACE leases for $375 per year. Pacesetter Corp., Marsh Road, Litchfield, CT 06759. Circle No. 113.

"Good to the last byte," says the manufacturer, is the response that any "smart cookie" would make regarding **Chips Ahoy! jewelry**. Hard gold leads on a white ceramic body form the basis of a charm or necklace. Circle No. 180, or write Chips Ahoy!, POBox 1199, Portsmouth, NH 03801.

Phoenix Digital Corporation of Phoenix, AZ, has introduced a new line of micro and mini **Plug-in service tools.** These Digital Signature Analysis Modules are being manufactured, says the company, to meet the ever increasing difficulties of test and repair in the industry. Basic product families include the LS 100-S-100, LSI-11, EXORciser bus-compatible series, besides the LS-105 Industrial Version and the LS-120 Hand Held self-contained probe group. For further information contact Phoenix Digital Corporation, PO Box 11628, Phoenix, AZ 85017; (602) 996-8262. *Circle No. 130.*

TSC has developed a two-pass **resident assembler for the 8080** microprocessor. The assembler is fully Intel compatible excluding macros, conditional assembly and logical expression operators. Free-format source is also accepted, obviating the need for colons and semicolons.

The assembler is reported to be extremely fast due to the hashing technique used by the label handler. Labels may be any length with 6 characters significant. Both passes and the initialization required for each are written as subroutines, making custom applications straightforward.

All standard pseudo-ops are supported plus such options as: pagination, titling, spacing, listing suppression (only offending lines will be printed), hexadecimal or octal output, decimal line numbers, hex, decimal, octal or binary constants and an alphanumerically sorted symbol table.

Object code may be output in the standard Intel ASCII tape format or directly into RAM. Break and escape keys allow halting or pausing the assembled source listing. If pagination is on, page limits may be specified to print a selected portion of the output.

5½K of RAM is required beginning at 1000 hex, plus source and symbol table space. A printed source listing and user's manual is available for $25 (order number SL80-12). $34.00 buys the source listing, manual and an object code paper tape in the Intel ASCII format (order number SL80-12P). Contact Technical Systems Consultants, Inc., Box 2574, West Lafayette, IN 47906; (317) 423-5465. Circle No. 110.

A new **Data Base Management System** (DBMS) and additional **16K RAM memory** for its DS9990 Commercial Computer Systems line were announced recently by Texas Instruments.

TI's DBMS 990 provides definition and data access which can be equated to commonly-used business documents. It includes a high-level data definition language and a manipulation language accessible through COBOL. Data control is provided by restricted access, password security of data items and logging. To minimize user overhead, TI said, optional DBMS 990 functions can be omitted if not required for the application.

DBMS 990 is offered on TI's DS990 systems as part of a commercial software package which also includes COBOL, Sort/Merge and the DX10 multiuser disk operating system.

In addition, TI announced 16K RAM memory and new packaging options for the DS990 line. System performance, packaging density and power requirements have been improved with the incorporation of the 16K RAM error-correcting memory featuring TI's TMS 4116 chip, the company said. With this enhancement, basic DS990 configurations may now be expanded in the base chassis to include up to 608K-bytes of main memory and to support up to six CRTs. An expansion chassis is available for larger system requirements.

Error-correcting memory systems using the 16K RAM MOS memory are available from 64K bytes to more than one megabyte. The minimum system is a single board with 64K bytes of error-correcting memory priced at $2880 in OEM quantities of 50. A one-megabyte configuration of five memory boards costs $37,920 at the quantity 50 OEM level.

The new packaging options include 70-inch cabinets for DS990 models 4, 6 and 8 and a 30-inch low profile enclosure for the Model 4. Three new commercial packages incorporating the new enhancements were also disclosed.

The Model 4 Commercial System includes the 990/10 computer with 128K bytes of 16K RAM, 10-megabyte disk, dual Model 911 VDTs, a Model 810 multi-copy printer and a choice of four enclosures: single-bay or dual-bay system desks, or 70- or 30-inch cabinets. Software included in the package is DX10 Commercial Operating System license, Sort/Merge and a choice of RPG II or COBOL. Installation of hardware and software is included in the system price of $35,500.

Aimed at the small business data processing market, the Model 4 Commerical System will present an alternative to users who have outgrown their existing RPG II systems or those who desire additional language capabilities of COBOL, TI said.

Also added to the DS990 product line are Models 6 and 8 DBMS. These systems feature dual 25- and 50-megabyte disks respectively. Each system includes a 990/10 computer with 160K bytes of error-correcting 16K RAM, four Model 911 VDTs, a 300-lpm printer, and dual 25M-byte or 50M-byte pedestal-mounted disks. Software included in each package is DX10 Operating System, Sort/Merge, COBOL and DBMS. Installation of hardware and software is included in the system prices of $71,000 for the Model 6 DBMS, and $78,500 for the Model 8 DBMS.

For further information, write Texas Instruments Incorporated, Digital Systems Group, P.O. Box 1444, M/S 784, Houston, Texas 77001; (512) 258-7305. *Circle 134.*

COBOL accounting packages compatible with Data General's microNOVA CS/20 will soon be available from Mini-Computer Business Applications, the company said. MCBA already offers CS/40 COBOL packages and hopes to have software for the CS/20 by the end of the year. Subject to change, license fees for the CS/20 packages will be the same as the current CS/40 license fees. For more information, contact Mini-Computer Business Applications, Inc., 4929 Wilshire Blvd., Suite 940, Los Angeles, CA 90010; (213) 936-7131. *Circle No. 135.*

Users of Interdata 8/32 series business computers can now install the **Software International General Ledger and Financial Reporting System.** Available from Software International's Small Business Systems Division, the new package gives accounting and financial personnel a data-base designed system. Features include a Report Writer for designing, implementing and controlling their own reports; roll-up and hierarchial versatility to perform dollar summarization in

a number of directions; and auditor-approved control techniques.

According to Small Systems Group, the financial reporting and control system provides "growing room" for future requirements. The new Interdata system includes support days for installation, training and educational assistance at no extra cost to the user.

Software International's Interdata package is priced at $15,000 for the General Ledger and Financial Reporting System. For more information, contact Software International, Elm Square, Andover, MA 01810; (617) 475-5040. *Circle No. 137.*

Sycor, Inc., announced a new **multifunctional operating system** designed to enhance the performance of its top-of-the-line 445 distributed data entry and processing systems.

Called Omni, the operating system features memory mapping techniques which utilize the 445 system's 256,000 bytes of main memory to offer users a variety of capabilities for virtually any application, the company said.

The Omni system allows the 445 user to concurrently run eight foreground and eight background tasks in virtually any combination of data entry, data communications and data processing. These 16 tasks can be running in COBOL, BASIC and TAL 2000 (Sycor's own Terminal Application Language), IBM 3270 emulation and utility programs.

With Omni, a 445 system can incorporate up to eight Data Station display units which may be under

the control of different systems programs, the company said. Economy of memory usage is achieved by systems programs being shared by Data Stations with no duplication of interpreters. Application programs can also be shared by multiple Data Stations.

The flexibility offered by the 445's multiple language interpreters allows users to run their application programs in any of the three supported systems languages. The operator requests the application program, which is automatically turned over to the appropriate systems program for execution without having to reconfigure the 445.

The Omni system enables the 445 to support interactive on-line data communication through IBM 3270 protocol while concurrently running a non-3270 communications task.

According to the company, user-oriented benefits include: relieving the data processing manager of the burden of scheduling many systems tasks; permitting the user to consolidate distributed data processing and on-line activities into a single system; furnishing each operator on the system with the equivalent of a Sycor 410 distributed data processing system; saving the user from having to dedicate the 445 system to only one set of tasks and exclude others because they are in another language; providing existing 445 users with no significant changes.

Sycor will provide the new Omni multifunctional operating system to users at no cost with first deliveries scheduled for April 1979. For more information, contact Sycor, 100 Phoenix Drive, Ann Arbor, MI 48104; (313) 971-0900. *Circle No. 138.*

PET owners need no longer be limited to crude pictures and plots determined by the 25 x 40 display, according to the Softside Software Group. SSG has developed a program to expand the PET's capabilities to a **50 x 80 display**. Users can individually control 4000 points. No modifications are needed to run this routine, said SSG. The system runs in two modes. The first plots 1,1 in the upper left hand corner and 80,50 in the lower right corner of the display. The second mode, useful for mathematical or graphing problems, plots 0,0 at center screen, making all four quadrants available. The program costs $6.95.

SSG also offers a **simulation game** called "Bicycles". This game puts you in charge of a bicycle company, which you must keep profitable. You must adjust prices and inventory as the seasonal market changes. You can use ad campaigns, but must watch out for inflation and breakdowns. A subroutine stores data on tape so you can resume the game where you last left off. Cost for a PET cassette is $7.95.

"Doodle", also from SSG, runs both with regular PETs and with those using the 50 x 80 graphics package. For $3.95 you can **use your PET as a sketchpad.** Features include a delete function as well as center and no show (moving without leaving a trail).

For more information, contact Softside Software, 305 Riverside Drive, New York, NY 10025; (212) 866-8058. *Circle No. 139.*

PASCAL high-level language support for 9900 family microprocessors is available from Texas Instruments. This software, designated TIPMX (TI PASCAL microprocessor executive), is a stand-alone, executive and run-time support library specifically designed for writing application programs in PASCAL. Microprocessor users can now generate PASCAL programs with the TI PASCAL compiler which presently exists on the TI 990/10 minicomputer, the company said. TIPMX may also be linked with an assembly-language application.

PASCAL is a general-purpose, block-structured language that fosters designs and implementations that are highly structured and are independent of processor architecture and instruction set. This feature not only enhances the maintainability of the software, but adds to the mobility of PASCAL-encoded algorithms through successive generations of microprocessors, TI said.

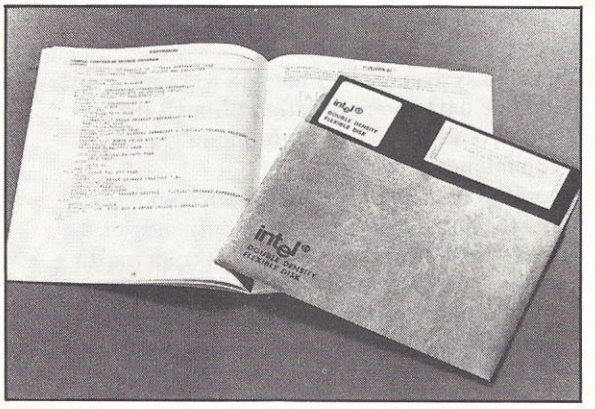
TI PASCAL is an extension of PASCAL as originally developed by Nicklaus Wirth. Designed as a language for teaching a systematic concept of programming, PASCAL is easy to learn because it excludes most of the exceptions, special cases and defaults which have made other languages hard to master. The readability of PASCAL makes the language especially useful when programs must be maintained by programmers other than the original author.

The TIPMX software is available on both floppy diskette or hard disk for the FS990 or DS990 development systems, respectively. The TMSW301F (floppy diskette) costs $500, while the TMSW301D (hard disk) costs $700. For more information, contact Texas Instruments Incorporated, P.O. Box 1443, M/S 653 (Attn: PASCAL), Houston, TX 77001. *Circle No. 136.*

Intel Microcomputer Systems Division's FORTRAN-80 operates on Intel's newest Intellec Series II Models 220 and 230 and previous generation MDS-800 and MDS-888 Development Systems as well. Exceeding the ANS FORTRAN 77 Language Subset Specification, ANSI X3J3/90, FORTRAN-80 is the first ANS FORTRAN 77 offered by any minicomputer or microcomputer manufacturer, according to Intel. An **applications language** rather than a system-type language such as PL/M, FORTRAN allows the system designer to create software modules that solve problems not well-addressed by other microprocessor development languages.

Applications involving a great deal of arithmetic processing, such as the calculations required in a control application requiring chemical analysis, are one designer problem. Part of the overall control software might typically require solving a detailed mathematical equation on incoming sensor data, then evaluating the result to determine what stimulus, control signal, to apply to the control process. FORTRAN-80, which supports the Intel floating point standard, easily accomplishes arithmetic processing. FORTRAN-80 has a complete complement of intrinsic functions, including all trigonometric functions and absolute value, for handling any arithmetic processing with which the design engineer might be faced.

Another past problem plaguing designers using microprocessor development systems was that of formatted I/O and the whole area of I/O handling. Now with FORTRAN and the ISIS-II run-time library, designers can easily produce formatted I/O. Because FORTRAN-80 is a problem-solving tool, the Intellec



Microcomputer Development System equipped with FORTRAN can perform stand-alone FORTRAN processing as easily as it can develop application software for microprocessor-based systems.

Like both PL/M and the 8080/8085 Macro Assembler, FORTRAN produces relocatable and linkable object code compatible with both of these languages. In addition, FORTRAN-80 supports full symbolic debugging with ICE-80 and ICE-85. It also contains sophisticated code optimization to ensure that compiled FORTRAN programs are highly efficient and use the least amount of memory possible.

FORTRAN-80 is available in single and double density floppy diskettes from Intel at $1750 for single units. For more information, contact Intel Corp., 3065 Bowers Ave., Santa Clara, CA 95051; (408) 249-8027. *Circle No. 140.*

Incoterm Corporation, a subsidiary of Honeywell, announced enhancements to its line of **financial transaction system hardware.**

"The enhancements will allow us to offer a more price effective product line," Samuel W. Adams, marketing vice president, said. He attributed the advanced product designs to improved technology, greatly increased production volume and extensive user experience.

"We're finding that comprehensive cash control software, together with a trend toward broadened branch networking to include large and small offices and a mix of teller and ATM requirements, have hastened the need for larger memory capacities and greater flexibility from the minicomputer-based intelligent transaction controller," he said.

These enhancements include additions to the intelligent transaction controller that add memory capacity up to 64K bytes of MOS executable storage, memory expansion modules to 128K bytes, a new

administrative printer, as well as teller station and network devices that enable users to maximize system configurations and to simplify installation.

According to Adams, these enhancements result in network-wide price/performance improvements. The MOS memory technology is software compatible with the present core memory products. The company's cash control software and transaction compiler language programming can be implemented directly.

The MOS memory systems are used in conjunction with dual drive diskettes where one drive is reserved for program loading. Protection and reload are also accomplished with the diskette unit.

The Incoterm Series 7000 financial transaction system is a line of flexible hardware supported by application software. Intelligent transaction controllers at the core of each action center module of the system easily accommodate communication speeds and software protocols of host computers.

The Series 7000 is modular and flexible, making possible various configurations to meet particular bank or individual branch requirements, the company says. For more information, contact Honeywell Information Systems, 200 Smith St., Waltham, MA 02154; (617) 890-8400, ext. 3739. *Circle No. 142.*

Johnson Systems, Inc., announced **Extended Capabilities** for users of the Johnson OS **Job Accounting Report System.** Designated Release 3, the newest version of JARS includes an additional set of System Use Reports and significant enhancements to the basic package.

For MVS installations, the Extended Capabilities are particularly valuable. All of the relevant data captured by MVS/SMF is now made available by JARS, both on the System Use Reports and as data elements in JARS Report Program.

A set of graphs and reports which amplifies the usefulness of JARS, the System Use Reports, are designed to help data center management profile system utilization, identify trends, and plan future resources and workloads. In keeping with Johnson Systems' philosophy of flexibility and user control, the contents of the reports can be dynamically altered to meet specific needs.

For more information, contact Johnson Systems, Inc., 8400 Westpark Drive, McLean, VA 22101; (703) 893-8700. *Circle No. 143.*

The Composition Systems Division of Harris Corporation introduces a **software package,** HNS2 "RELEASE III", for its 2500 Copy Processing Systems. The RELEASE III package adds capabilities and improved system performance to HNS2 software now offered by Harris on its 2500 product line.

RELEASE III software supports additional core memory beyond 128K, powerful 11/70 CPUs and additional on-site user changeability for directories, levels of password security, maintenance of credit files and nearly 30 other new features.

RELEASE III software features a Harris hyphenation package. According to Harris, the new "Hyphena-

tion Plus" package has been tested with 100% accuracy in processing a Thorndike-Lorge listing of more than 60,000 words. The Thorndike-Lorge listing contained words occurring at least once in a million times, and the system hyphenated them perfectly as listed in Webster's New World Dictionary, second college edition. In addition, Harris has added a user updatable exception word dictionary.

In the area of processing hyphenated and justified copy, Harris RELEASE III software: estimates copy depth using six user changeable default parameters for local or wire stories; enables multiple users to perform Hyphenation Justification (H&J) tasks simultaneously, improving overall throughput and interactive H&J response; and automatically H&Js a story while it is being sent to an editor or copy desk.

For more information, contact Harris Corp., Communications Systems Div., 505 Rodes Blvd., Melbourne, FL 32901; (305) 259-2900. *Circle No. 144.*

University Computing Company has announced the Version 4.1 enhancement package to its UCC FIFTEEN **Job Recovery Management System.** Version 4.1 will offer IBM 3850 Mass Storage support as well as new more flexible options for assuring that production JCL does not change without the corresponding update to the UCC FIFTEEN data base, UCC said.

With Version 4.1, the user can decide if additional input GDG data sets are to be allowed on a rerun or restart condition. The user then has the option to either ABEND the job or to generate a report specifying which additional GDGs were allowed.

Overrides to change the GDG bias on either input or output are now allowed. Both of these enhancements provide flexible use of UCC FIFTEEN in the different operational environments. Prior to Version 4.1, changes of this type were never allowed to assure that production JCL changes were accomplished with a corresponding data base (CMT – Catalog Management Table) update, the company said. Now the user can make temporary updates such as the above and UCC FIFTEEN will accept and report on the job as submitted.

Version 4.1 also offers support of the 3850 Mass Storage device and will automatically mount mass storage volumes to scratch and uncatalog the unwanted data sets.

UCC FIFTEEN, Job Recovery Management System, provides an automated means to handle jobs which need to be restarted or rerun for any reason, thus eliminating manual procedures and the costly mistakes which result, UCC said.

For more information, contact University Computing Company, 8303 Elmbrook, P.O. Box 47911, Dallas, TX 75247; (214) 688-7100. *Circle No. 145.*

A **real estate software package** designed to help brokers increase their sales and manage their businesses better has been announced by Texas Instruments Incorporated.

Keyed for use with TI's standard SR-60A programmable desktop computer/calculator, the software package comprises 24 programs improving the accuracy and speed with which residential and commercial realtors can perform traditional – as well as new – functions. These functions span applications from buyer qualification and home selection to projecting cash flow analyses, rates of return, various methods of depreciation and loan amortization schedules.

The system – the computer/calculator and the software package – provides the power of a computer with the simplicity of operation of a calculator, thus bridging a gap for many real estate operations, TI said.

Buyer qualification programs, for example, help brokers determine in minutes what kind of house

the buyer can afford. The SR-60A also estimates future monthly payments for as many years as desired, taking into consideration mortgage balances, property taxes, insurance, appreciation and all other financial factors affecting a potential home buyer.

Twelve residential realty and office management programs estimate optimum price ranges for buyers, determine appreciation and predict selling prices of individual homes and neighborhoods, evaluate sales performance and advertising results, speed analysis of buyer qualifications, measure branch office cash flow and market turnover, calculate taxes and rental income and provide office income and expense accounting according to National Association of Realtors formats.

In addition, 12 commercial/investment programs offer rapid calculation of internal rate of return, financial management rate of return, component and composite depreciation, cash flow, annual property operating data, installment sales analysis, excess depreciation recapture, individual tax analysis, required reversion to obtain specific yield, yearly amortization schedules, automatic curve forecasting of short-term variables and income averaging.

Available in major markets, the SR-60A real estate software package costs $335; the standard SR-60A programmable desktop calculator, $1995. For more information, contact Texas Instruments Incorporated,

(Attn: SR-60A Real Estate), P.O. Box 10508, M/S 5890, Lubbock, TX 79408; (806) 747-3737, X-2406. *Circle No. 141.*

Multi-user microprocessor development is now possible using the Tektronix 8001 Microprocessor Lab, a host-computer and microprocessor development software from The Boston Systems Office, Inc. (BSO). A company doing microprocessor system design can configure these products into a total microprocessor development system which allows any number of simultaneous users – from two to more than 100 designers – to perform software development, hardware integration and debugging at the same time.

Michael Rooney, BSO's president, said, "When a company decides to implement a multi-user development team system, we will supply enhancements to our cross assemblers and linkage editors that reside on the user's computer so the user can produce 8001 compatible object formats. This extra service is provided at no additional charge."

Software debugging and real-time emulation for several different microprocessors is possible with the 8001. This feature ensures that the system can be used in subsequent projects without requiring a new development system and retraining of design team members, said the company.

BSO provides microprocessor assemblers and cross linkage editors for many commercially available microprocessors. BSO cross assemblers, written in assembly language for Digital Equipment Corporation PDP-11 and Data General Nova and Eclipse computers, are typically up to 20 times faster than similar products, according to the company. Additionally, BSO will provide the software necessary to down line load directly to the 8001 Microprocessor Lab.

The Tektronix 8001 Microprocessor Lab is a total debugging tool for microprocessor-based systems, providing development support for hardware/software integration, with the ability to emulate several microprocessor chips, including the Intel 8080A and 8085A, Motorola 6800, Texas Instruments TMS9900 and Zilog Z-80. The 8001 offers three emulation modes: prototype-independent software debugging, partial emulation and full in-circuit emulation. Additionally, the 8001's Real Time Prototype Analyzer option captures microprocessor activity while the prototype is running at full speed.

When a company's multi-user system needs expansion to accommodate more users, the company can purchase additional 8001s and terminals, and if needed, trade up to a more powerful compatible computer. To add development capability for different microprocessors, the company can purchase an Emulator Support package for the existing 8001 and another cross assembler for the host computer.

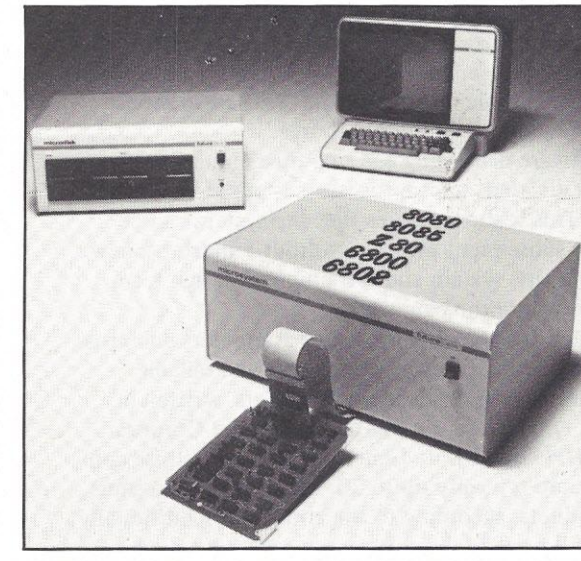
For further information, contact Logic Development Products, Tektronix, Inc., P.O. Box 500, Beaverton, OR; (503) 644-0161. *Circle No. 146.*

Rapidata, Inc., a nationwide remote access computer firm specializing in financial services, announced

a new release of FISCAL, its **financial modeling service.**

The new version of FISCAL results from Rapidata's financial applications experience in more than 250 different installations, the company said. According to Charles Krempa, FISCAL product manager, "FISCAL is an integrated system for organizing, manipulating, analyzing and reporting financial information. Its flexibility provides both the experienced and inexperienced computer user the opportunity to produce timely and correct solutions to their business requirements."

FISCAL will handle a broader range of analytic financial applications than any other financial language, according to the company. The application can be



implemented with a minimum of code, eliminating the need to program around language limitations and avoiding sacrificing desired features. Easy to understand and maintain and simple to operate, the resulting model has the necessary flexibility to eliminate the need for multiple variations of the model.

According to the company, typical FISCAL applications include: five-year forecasts, one-year operating plans, corporate models, budget preparation, performance analysis, capital budgeting, capital investment analysis, financial consolidations, cash forecasting and planning, merger and acquisition analysis, real estate analysis, product line planning and credit analysis. For more information, contact Rapidata, 20 New Dutch Lane, Fairfield, NJ 07006; (201) 227-0035. *Circle No. 147.*

Apple Computer, Inc. of Cupertino, CA, announces that it is going to provide owners of its computers with **stock portfolio information** and other financial services.

Using a telephone link-up, Apple II Computer users can dial Dow Jones & Co., Inc.'s Stock Quote Reporter Service for fifteen-minute-delayed stock and bond quotations. This information, along with software provided by Apple, will enable users to determine current portfolio value, short and long term

gains, and rate of return, among other things. At a future date, Apple II users will be able to use the telephone link-up to obtain current news on companies in their portfolios.

Cost of the stock quote service includes a one-time fee of $25, plus a usage charge of $3 for the first three minutes, plus 50¢ a minute thereafter.

The telephone link-up service includes a large computer facility in New Jersey hooked into a nationwide communications network which dispenses current stock information from the Dow Jones reports.

Presently, users wanting access to such network information have had to purchase a terminal and modem, permitting the terminal to communicate over telephone lines to the network. Like the terminal, Apple connects to the network via a modem and accesses the network by way of a password acquired at the time of purchase. The Apple Network brings to the network computer power which simplifies the task of logging and processing information.

To log onto the Dow Jones Network, the Apple user loads Apple Financial I (a stock quotation routine) program into his machine, then follows instructions displayed by the program. These instructions tell the user to dial a local number of the Dow Jones Network and then insert the telephone receiver into a modem. Once contact is made between the Apple II and the network, the user is requested to enter his password to gain information from the network.

Besides the log-on feature, Apple II is also very cost-effective in use of network time. With Apple Financial I, all symbols for desired quotations are entered prior to logging on. Thereafter, Apple requests desired quotes from stored information without further keyboard input. Thus, time on the network is always spent accessing and transferring data and never involves costly manual input typing time.

Apple Financial I permits access quotes for up to 21 stocks per portfolio. This number can be increased by adding additional cassettes, each of which contains 21 stocks. Thus it is possible to have a single large portfolio or a number of small ones. With this system an investment counselor can quickly access quotes for his clients simply by loading the appropriate cassette. Moreover, stocks in a given portfolio can easily be added or deleted.

With Apple Financial II, the amount of processing performed by Apple is increased. The program permits the calculation of a portfolio's current value (up to 16 stocks) and calculates short and long term gains or losses for each stock as well as cumulative profit or loss figures. Thus, an investment counselor with a number of clients has instant access to the performance of each stock in any of the many portfolios being managed. Like Apple Financial I, this second program is claimed to be easy for the investor.

Other programs in the planning stage include a news retrieval routine.

For more information, contact Apple Computer, Inc., 10260 Bandley Drive, Cupertino, CA 95014; (408) 996-1010. *Circle No. 149.*

CLASSIFIEDS

WHAT'S COMING UP

Polymorphic System 88 owners: Having trouble running software orged at 0000H due to the on board system monitor? A new **SUPER-MONITOR** is now available which permits the use of low off board RAM for program storage. The SUPER-MONITOR plugs into the two remaining ROM sockets on the Poly Processor Card and leaves the original monitor intact. The extended monitor contains many useful features which will give enhanced performance to your Poly 88 along with freeing up low memory. The SUPER-MONITOR features: DUMP, MOVE, VERIFY, EPROM PROGRAMMER, FILL, IN, OUT, CASSETTE SAVE, CASSETTE LOAD, SEARCH, SERIAL PORT DRIVER, GOTO, MEMORY MODIFY and RETURN TO POLY MONITOR. Available as a two chip set on 2708 EPROMs with complete documentation for only $59.00, plus shipping, from Computer Hobbies Unlimited, 9215 Midlothian Turnpike, Richmond, VA 23235; (804) 320-7933. Circle No. 107.

Now **Micropolis Disk** users can also run, without any hardware changes, CP/M with all the features available to the users of the system on standard floppy disks. Also supplied by Lifeboat Associates for the CP/M user with Micropolis hardware are Microsoft Disk Extended Basic and FORTRAN-80, an Intel-compatible macro assembler, MAC, and a symbolic debugger, SID, both by Digital Research, CBASIC by Software Systems and BASIC-E from Monterrey Naval Postgraduate School.

CP/M has become the most widely used S100 Floppy Disk Operating System. Its features are well known and include dynamic allocation of diskette storage, relocatability of system in memory, intransic commands to save, rename, erase and display directories of files, and complementary context editor, assembler and dynamic debugging program.

The universal popularity of CP/M makes it effectively the software exchange bus for S100 systems. Vendors of hardware or software supporting CP/M include IMSAI, Cromemco, TDL, Digital Systems, Tarbell Electronics, Microsoft, Digital Research, S.D. Sales and others. The price for CP/M on Micropolis (Version 1.4) is $145. For more information, contact Lifeboat Associates, 164 West 83rd Street, New York, NY 10024; (212) 580-0082. Circle No. 106.

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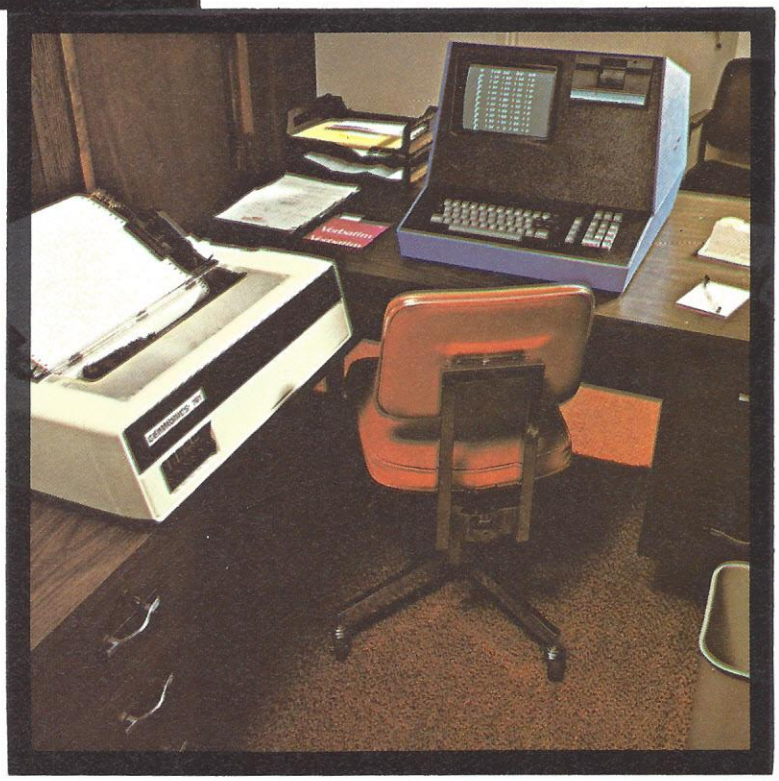

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